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This report presents severl alternative methods which may be employed by local authorities in identifying likely prospects for local industrialization, and describes a specialized input-output technique to define inter-industry relations and inter-regional relations of industries. This technique is applied, for illustrative purposes, to three labor-oriented growth industries (electronics, optical, and glass) in the United States. One purpose of the technique is to provide a critical central system of analysis, after which the detailed factors might be reviewed if the particular industry is considered a candidate for location. Appendixes include formulas for the Cobb-Douglas function and the share of labor, analysis of inter-industry relationships, determination of relevant regions, and checklist for site selection. (EM)

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DEVELOPING JOB OPPORTUNITIES 2

L.H. KLAASSEN

methods of selecting industries for depressed areas

an introduction to feasibility studies

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ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT
PARIS 1967

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methods of selecting industries for depressed areas

an introduction to feasibility studies

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LEO H. KLAASSEN
Netherlands Economic Institute

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ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

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L. H. Klaassen.

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FOREWORD

This is the second volume in the series of studies in the field of area redevelopment. It follows "Guidelines for Programmes for Area Economic and Social Redevelopment", which outlined the methods of organizing national and local agencies for area development and discussed the types of research programmes and policy which such efforts require. It dealt both with the research conducted by central and local governments and the functions of the expert in developing local government policies. Particular stress was placed upon the importance of each area's "hidden potentialities", which can often transform its economic prospects.

This report presents, in Part I, Chapter 3, several alternative methods which local authorities may employ to identify likely prospects for local industrialization. Part II is devoted entirely to the detailed description of the specialized methodology developed by the author, based upon the input-output approach, to define the inter-industry and inter-regional relations of industries.

The use of this technique is illustrated in its application to three labour-oriented growth industries in the United States for which statistical data now exist. The labour-oriented industries were not selected because of any prejudgment of the merits of assigning priority to these industries for any specific area. The arguments for and against such a policy are numerous and would have to be resolved in the specific area. The choice was made because the number of illustrations necessarily had to be limited and labour-oriented industries do make immediate contributions to area redevelopment. The growth industries were defined in relation to the increase in employment. Of course, they are those most likely to contribute to total growth.

The report presents a method and logic of analysis which is widely applicable and can help local authorities, who are considering which industries to canvass, to identify those which should receive priority. It helps to relate selection to such primary factors as inter-industry and inter-regional relations. It offers a first approximation for examining likely prospects to which can be added, according to the views of the local and area authorities, those other qualitative criteria which appear essential.

A careful approach to the selection of industries has become particularly important as more business enterprises employ sophisticated economic techniques of analysis when choosing their new plant sites. Managements have encouraged and benefited from research and writings by regional economists. Local areas have, therefore, to match this careful analysis to be forewarned of the results of managements' surveys as well as to be able to check on their findings. The authorities have to be fully aware of the advantages and disadvantages of the area for specific industries, both to save time and energy and to minimize the disappointments which have often led to the abandonment of development activities.

The study of industrial locational requirements and of inter-industry and inter-regional relations can enable all authorities to compare their own social infrastructure, economic and manpower resources and assets to determine which can be further developed and how programmes should be carried out to make areas eligible for new industries. Moreover, the above analysis will provide the authorities with information on the mobility of specific types of ventures so that they will be aware of the prospects of these enterprises' remaining in the community.

The use of the detailed statistical data in this report may initially discourage its application to areas without adequate information. Actually the central concern is the logic of the analysis, or the questions which the statistical procedures seek to answer. The logic can be followed and the questions raised even where the data are not abundant, as was pointed out in the first volume. Where such information is not accessible, the local authorities have to resort to the knowledge and judgments of experts who can fill the gap until a statistical base is created.

The method of analysis provides a key to the selection of possible industries to consider for location. Following these choices, there is still the question of determining the appropriateness of the specific venture. Therefore, this report is called an "introduction to feasibility studies".

Attached to this report is an elaborate "Site Selection Check List" which indicates the wide range of considerations which may influence the final decision by the individual enterprise. One purpose of the methodology outlined in the present report is to provide a critical central system of analysis, after which these detailed factors might be reviewed if the particular industry is considered as a possible candidate for location.

The Manpower and Social Affairs Committee has indicated that "the Manpower authorities should strive to ensure that the manpower objectives are fully recognized by all relevant sectors of government and that the employment objectives are given the high priority they deserve from the point of view of economic, political and human interests". The close coordination of manpower and economic policies is, therefore, crucial and the development of jobs for the unemployed or underemployed persons in depressed or underdeveloped areas is an essential subject of mutual interest to the policy makers in both areas. The present report is designed to contribute to more effective efforts in this field of job development.

Solomon BARKIN

Deputy to the Director,
Manpower and Social Affairs Directorate
and Head of Social Affairs Division,
OECD, Paris

SUMMARY

An introductory section to this study examines some general aspects of area redevelopment policy and the role of an industrialization policy in such a policy.

Industries to be selected are labour-oriented growth industries. Whilst there are alternative definitions of a labour-oriented growth industry, for the purpose of this study the size of an industry is measured by employment and labour intensity by the proportion of value added paid to employees.

Several methods can be used to select industries that could be attracted to the area. The most important of these, together with their advantages and disadvantages, are reviewed. The method adopted is based upon the weighted inter-industry relationships method, in effect a modified and elaborated Perloff-access approach. This method was applied to the regional distribution of three manufacturing industries in the United States.

The report consists of two parts: the first deals with area industrialization policy in general and the second examines the method that might be used as a basis for such a policy.

It is assumed that the relative levels of communication (including transportation) costs for the products and requirements of an industry determine both the propensity to export the products from a region and to import the requirements from other regions.

A relationship is established between, on the one hand, the gross output of an industry in an area and, on the other, the demand for its products stemming from all other industries and final demand sectors in the area together with the area supplies of its most important requirements. The coefficients of this relationship (the attraction coefficients), which can vary between 0 and 1 and whose sum is unity, are estimated for the electronic components, optical and glass industries.

For both the electronic components and glass industries, the values of the total demand attraction coefficients were found to be very close to unity. This means that both industries are strongly market-oriented. For the optical products industry the values remained undetermined indicating that communication costs do not play a significant role in the location of this industry; the optical products industry is completely footloose as far as both inter-industry relationships and the final demand are concerned. A supply of skilled labour is considerably more important as a location factor.

The correlation coefficients of the derived relationships were of the order of $+0.75$ for the standard geographic divisions of the United States. By combining various divisions, a set of larger areas was obtained for which the coefficients approached to unity. These combinations of divisions are called *relevant regions*. Within the relevant regions the electronic components and glass industries may be said to be footloose as far as inter-industry relationships are

concerned. The relevant regions are of such a size that both industries might be footloose in a country of an average European size.

The manner in which an area could use the type of results which the analysis yields, is outlined. It would be preferable for a central government agency to undertake the necessary studies for the growth industries and acquaint all areas with their general requirements. The local authorities would then need to compare these industry requirements with the structure of their own areas and use the results as a basis for their local industrialization policies.

It is very apparent that a rewarding further feasibility study would be for the Pacific geographic division. (The states of California, Oregon and Washington). This division imports 80 per cent of its optical product needs, whereas of the two most important requirements of this industry, namely paper and chemicals, 75 per cent and 64 per cent respectively of its own production are exported. This kind of study would obviously be useful for smaller regions.

In the case of smaller areas, due consideration should be given to the state in which the area is located and the geographic division within which the state is located. Net imports by the area, state and geographic division of the product in question means that there may be opportunities for exports to the rest of the state and division.

Finally, it is proposed that local authorities should carry out "location-simulation" studies, that is, studies in which: the industry "best" suited to the existing industrial pattern of the area is first selected; a second industry is chosen on the assumption that the first industry actually locates in the area; and the procedure is repeated assuming that both industries are present, etc. In this manner a group of industries could be selected for which location in the area seems profitable when compared with others.

In order to carry through the industrialization programme, consideration should not only be given to an industrial estate where industries might locate but also to labour-supply problems and the provision of economic, social and cultural amenities of a general nature.

INTRODUCTION

The purpose of this report is to explore certain methods that might be used as a basis for local industrialization policy. In Chapter 1, some general principles of area development policy are discussed and in the second, three labour-oriented growth industries are selected for a more detailed analysis. The choice of labour-oriented growth industries follows logically from the fundamental objective of area development policy: to employ or re-employ as many workers as possible. It should be stressed here that, if secondary employment created by new industries is taken into account, labour-oriented industries do not necessarily contribute most to local employment. A capital-intensive industry might create so much additional employment in auxiliary industries that its contribution to total employment is actually larger than that of the labour-oriented industry. For two reasons however, labour-oriented growth industries were taken as a starting point.

The first reason is that labour-oriented industries give an *immediate* contribution to local employment while capital-intensive industries, if they do, do so only in the long run. The choice of labour-oriented industries is thus more a matter of priority than a basic principle.

The second reason is that in fact our knowledge of the "*clustering*" of industries is extremely limited and actually one of the main targets of this study is to gather more knowledge on the linkages between industries and their influence on the tendency to cluster. Basically, therefore, only after this study has been finished (and then, not only for the three industries selected, but for *all* industries) assumptions could be made about indirect effects of local industrialization. For these two reasons the study concentrates on labour-intensive industries. Chapter 3 is devoted to a review of versions of methods of industry selection. There are many such methods, but only those that seem relevant in the context of this study, are referred to.

In Chapters 4 to 6, the inter-industry relationships of the three chosen industries—the optical, glass and electronic components industries—are studied. In the following Chapters 7 to 12, a model is applied to the data presented in the three preceding chapters in order to determine the quantitative importance of the locational requirements of the three industries. Finally, the significance of the results for area-industrialization policy is emphasized in Chapter 13.

Although the effect of central government policies on regional development and industrialization is given some consideration, the study is mainly focussed upon the role of local authorities in area (re)development. The reason for this is obvious. Although central government policies are, in several countries, important in determining the future distribution of industry, it is the local authorities that are faced with the practical consequences of these policies, and also they frequently adopt measures which are considerably more important for the area than national policy. Moreover, it is the task of the local government to provide the new industries locating in the area with the necessary facilities, public utilities, roads, communications etc., and to provide amenities for the workers employed by the industries and for their families. This more immediate and wider responsibility of the local authorities justifies an examination of industrialization from the area's point of view, and this study is intended as a contribution to this approach to a rational area industrialization policy. Consideration of central government activities in the field of industrialization is limited to those that might support the local authorities in their own efforts for a more rapid industrialization of their areas.

The study is related to an earlier one[1], published as No. 1 in the Series: "Developing Job Opportunities" of the OECD Manpower and Social Affairs Directorate, Social Affairs Division. This earlier report contained a general review of area redevelopment problems and proposed further studies that are important for giving a basis for effective area redevelopment policies. One proposal concerned the locational requirements of labour-oriented growth industries, the problem to which this volume is devoted.

"The selection of the most appropriate export activities for a specific area's problem would be made much easier if models of the locational requirements of growth industries were developed. It may be assumed that the redevelopment of labour-surplus areas would be less difficult if employment problems were solved by the establishment of labour-intensive growth industries, the establishment of these industries being based in part on the available manpower both from the quantitative and qualitative point of view. Cases in point might be certain branches of tool-making, research institutions, tourism and the like. If a sufficient number of such locational profiles were at the disposal of local developers, their otherwise difficult task would be reduced to collecting and inserting into the model a prescribed set of data, part of which would already have been generated by the aforementioned studies"[2].

It is with these principles in mind that the following study has been written.

---

[1] Leo H. Klaassen, *Area Economic and Social Redevelopment, Guidelines for Programmes.* OECD, Paris 1965.

[2] Op. cit., page 82.

Part 1

LOCAL INDUSTRIALIZATION POLICY AND METHODS

Chapter 1

LOCAL INDUSTRIALIZATION POLICY

1.1. Introduction

A local industrialization policy is an essential element in a general area development policy. Since the principles have been fully discussed in an earlier volume it is sufficient to consider the relevance of its main characteristics to the present study[1].

1.2. Depressed areas

The existence of relatively underdeveloped areas in many developed as well as underdeveloped countries has given rise to much interest in the chances of promoting the development of these areas and in designing programmes and policies for obtaining a more rapid growth of their economies. In the case of developed countries, however, it would seem that sufficient attention has not always been paid to the fact that the different characteristics of depressed areas require a flexible regional policy. In order that the authorities can implement an area development policy successfully, full account must be taken, for example, of differences in structures of the various areas and of area differentials in income and employment levels, both as they exist at present and also their likely future values. That there exists a dynamic aspect to the development of the different areas of a country means that not only should the general area redevelopment policy be regionally differentiated but also that it should be couched in dynamic terms. In fact, the policies of many western countries are static, being based upon the existing situation and paying little or no attention to developments over time.

If the expected rate of growth of the various areas and their respective levels of activity are both taken into account, we may distinguish between four types of area: prosperous areas, in which both the level and the growth rate of activity are high; potentially depressed areas, in which the level of activity is still high but the expected growth rate low; developing depressed areas, in which the expected rate of growth is high but the level of activity is still low; and finally, depressed areas, in which both the level and the future growth rate of activity are low. A single regional policy applied uniformly to these different types of area could not be expected to attain optimum results. A developing depressed area requires a policy that would stimulate the growing activities; in a potentially depressed area a policy of retardation and reconstruction is needed; and in a depressed area complete reconstruction seems to be the only solution.

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[1] Leo H. Klaassen, op. cit. See also U.S. Department of Commerce, Area Redevelopment Policies in Britain and the countries of the Common Market, Washington, D.C., 1965.

1.3. CENTRAL GOVERNMENT AREA REDEVELOPMENT POLICY

Most central government area redevelopment policies do not allow for such flexibility as this. All areas with persistent unemployment—the usual criterion adopted—receive, in principle, identical assistance in their attempts to stimulate their economies; areas with full employment, whether or not this is likely to be maintained in the future, receive no such an assistance. Neither do national economic policies normally include any provision for regional flexibility. This type of policy is mostly based on national averages and is aimed at national targets, and only very occasionally are central governments aware that the policy has different implications for different regions. If the general economic situation requires deflationary measures, these are taken, regardless of whether the inflationary pressure is widespread, or is being experienced only by certain regions.

There is a further consideration which militates against the balanced long term growth of the various regions. Central government seem to be quite unanimous on the score that there is but one way of solving the problem of regional inequalities, namely, to take new activities to depressed areas. An alternative solution, emigration from the area, is being considered in only a very few countries. To some extent this is understandable. It is difficult for the government to exempt certain areas from assistance because of their lack of potential. It is especially difficult when, if the policy is to be consistent, the government at the same time *should* be giving assistance to those rapidly developing areas which offer the best chance of satisfactory results. The solution chosen by many governments may, in fact, diverge a little too much from that dictated by such a purely economic approach.

Let us distinguish between a policy that seeks to help areas, regardless of their potentials, *because* they are lagging behind in development and one that is guided only by the need to stimulate actual and potential development in the economy. The former will be termed a *social* redevelopment policy; it channels assistance to certain areas simply because they are poor. The latter will be termed an *economic* redevelopment policy; it seeks to promote promising developments. On two grounds, each central government development policy is a compromise between an economic and a social redevelopment policy. Firstly, in most developed countries certain areas are "overdeveloped". That is, some large agglomerations develop so quickly that substantial diseconomies of scale (on account of congestion), huge urban renewal programmes, and extremely expensive improvements to the general infrastructure, etc., seem inevitable if growth is not to be retarded. In Europe, London, Paris, the Ruhr area and the Dutch rimcity afford examples of such over-development. A policy of relative decentralization for these overcrowded urban areas seems desirable and, in all the cases cited, is actually being pursued. If effective, such a decentralization policy benefits other, less quickly developing, areas.

Industrial estates are an important instrument for promoting this kind of decentralization policy:

> "The need to co-ordinate industrialization and urbanization policies is apparent in any consideration of the industrial estate, which can play an important role in both sound economic development and sound urban development, and can serve as an important bridge between industrialization and urbanization policies.
>
> Industrial estates should be utilized as part of a broader governmental policy to guide the location and development of industry in order to achieve

two basic objectives: industrial development and decentralization. Industrial development policies have used industrial estates to accelerate industrialization and employment opportunities, to encourage foreign investors to locate manufacturing plants within a particular country, to foster and modernize small and medium-sized firms and to relieve hardship in depressed areas by expanding and diversifying the industrial base. Decentralization policies have used industrial estates to decentralize population from large urban centres, to provide an economic base for a new town or growing suburb of a metropolitan area, to encourage the development of rural and under-developed regions within a country and to maximize the opportunities afforded by hydroelectric power. In addition a third and more recent policy has sought to use industrial estates as a means of revitalizing city centres, thereby widening opportunities for urban development"[1].

The effectiveness of decentralization policies in Western European countries is not to be evaluated here. However, it should be emphasized that there are good reasons why a development policy not always favours the most rapidly developing areas for further stimulation. The creation of secondary nuclei (growth centres) seems to promote a balanced regional development in a more rational way.

The second reason is the existence of certain social goals. Depressed areas are usually characterized by an obsolete infrastructure, a relatively unfavourable age-distribution of the population resulting from continuous emigration from the area, and, for these reasons, poor prospects of renewed activity. Yet, in a properly functioning democracy each member of the community has a right to have access to, at least, the basic facilities in the area in which he lives. For this reason alone, no government is prepared to abandon depressed areas to their fate.

It seems logical, therefore, that the central government policy should contain three major goals: the avoidance of too large urban concentrations in the country; the stimulation of the growth of properly chosen development nuclei; and the provision of basic facilities for all parts of the country.

The question of the concentration of government support in development nuclei is a very important one. Is it true that the large urban concentrations suffer from diseconomies of scale, and that virtually all middle-sized communities offer potentially large economies of scale. In order to reach the minimum size of population required, perhaps something in the neighbourhood of 250 thousand people, a concentrated effort seems to be needed. Naturally, the selection of development nuclei should be based on such appropriate criteria as future development prospects, the nature of the present infrastructure and the cost of adjusting this infrastructure to meet the new situation.

1.4. LOCAL REDEVELOPMENT POLICY

Implicit in the above remarks is the fact that most central governments play an important role in the area redevelopment policy. In practice, however, the participation of the central government varies considerably from country to country—according to the nature of the taxation system, for example. The more this system is centralized, the larger is the influence of the central government on area redevelopment. A high degree of decentralization in the taxation system, as is found, for example, in the West German "Länder" and the Finnish municipalities, endows the local governments with greater opportunities for formulating and implementing development policies. This does not imply that only the local development policies of communities in a country with a decentralized taxation system are likely to be successful. The way in which the funds are dispensed can be as important, in this context, as the source of the money or even the total amounts available.

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[1] *The physical planning of industrial estates.* United Nations, New York 1962, page 1.

The role of the local government is thus an important one; this is true both of those communities or areas which are, and those which are not, chosen by the central government as a development nuclei. The local government bears the basic responsibility for the development of its area, either on its own initiative or in order to integrate with, and complement, the plans of the authorities at a higher level. There can be little doubt that the local government is better equipped for these tasks than the central government. It knows the attitudes of the community, the abilities of its industrial managers, the natural resources which are available, much better than any employees of the central government. Moreover it is seldom the desire of the central government to treat the questions in the same degree of detail as the local government does, since the target of the central government is simply to attain a reasonable distribution of activities within the country, for which purpose very general objectives suffice. The local governments must fill in the details of the national policy and, even more important, depart from its requirements when this seems appropriate and beneficial to the area in question.

An example of a complementary local policy which provides considerable scope for local initiatives, is the nuclei policy of the central government, which aims at creating suitable conditions for growth in a limited number of nuclei that will become the future centres of larger areas. The central government measures are intended to raise incomes and population in these centres, as quickly as possible, to levels at which a process of self-sustained growth will be set in motion and no further subsidies required. Whilst these nuclei are to be the principal centres of the chosen areas, there may also be centres of lesser importance with specific roles to play. For, in every area we find a hierarchy of communities, all of them playing their parts in the economic, social and cultural life of the area. An increase in the activities of the main centre of the area means that the tasks of the other centres become more important and there arises a need for more local government activity and initiative in these centres. The principal city of an area—which after all is only the apex of the pyramid of economic activities in the area—is not the only centre with any importance. Every local action, if properly prepared and integrated into a more general framework for progress, contributes to an area's welfare. Efforts to improve the economic base of the area are of particular importance and, consequently, local industrialization policy receives much attention in this study. It should be realized, however, that industrialization policy alone will not be sufficient to raise the welfare of an area to a higher level. Infrastructural improvements of many sorts—economic, social and cultural—within the limits determined by the area's income are also indispensable. They too merit further study, but are not treated in this report.

It would seem that a local redevelopment plan should contain the following elements in order to provide a suitable base for local redevelopment policy[1].

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[1] Leo H. KLAASSEN, op. cit.

"A. *Economic Plan*

This plan, derived from the results of basic research in the area, covers the overall economic development of the area. It contains estimates of desirable rates of increase of income and employment and it outlines methods of achieving these objectives. Estimates are also given of required investments in both the private and the public sectors, with special emphasis on roads, industrial sites and energy.

The economic plan is to be considered only as a guide in making specific decisions.

B. *Social Plan*

In the social plan, detailed targets are set for education training and retraining, low rent housing, etc. Necessary current expenditures and future investments and expenditures on these items are estimated on the basis of the expected development, as well as of independent social considerations.

C. *Physical Plan*

In the physical plan, the economic and social plans are integrated into a master plan for the whole area. The task of the physical planner is to unite all necessary future land uses into a harmonious, attractive and efficient physical pattern. Transportation must be, urban renewal might be, an important part of a physical plan.

D. *Financial Plan*

There are important financial implications to all three plans mentioned above. The plans, perforce, can only be realized to the extent that the financial means available will permit. It is thus absolutely necessary that future expenditures be balanced against the income flow of the area, derived from local sources as well as from central government subsidies. It follows that the time-schedule of the plans must conform with the area's estimated flow of income."

1.5. Local industrialization policy

That only three manufacturing industries, which seem to have certain advantages in the context of area (re)development, are examined in this study, does not imply that the manufacturing sector is the only one which can feature in area redevelopment policies. It is well-known that in highly developed countries the tertiary sector, or service-activities, grow considerably faster in terms of employment than the secondary, manufacturing activities. There are however, several reasons for the choice of manufacturing industries.

Firstly, in most developed countries, more and better data are available for the manufacturing sector than for services. Only certain services are included in the censuses, and the measurement of their level of production is poor, making a thorough analysis of their regional distribution difficult. Secondly, service-activities are always linked if not with consumer activities then with secondary activities, and therefore, to a large extent in their size and importance in a given area are determined, both by the area's general level of welfare and the level and structure of industrial activities. For this reason, the direct promotion of service-activities does not often seem to be a suitable way of developing an area. Only the relatively few independent service activities, such as scientific research or tourism, would be appropriate for this approach. The third and most important reason is that, although employment in the manufacturing sector as a whole might be practically stable in many countries, we will see that within the manufacturing sector, many activities decline and, simultaneously, many others employ workers in growing numbers. Thus, those manufacturing industries in the United States where the labour forces are expanding account for some 42 per cent of total employment in the manufacturing sector. The average rate of growth of these industries, again in terms of total number of employees, between 1954 and 1958 was 9 per cent. It is true that this increase was swamped by the decrease of 8 per cent during the same period in the remaining 58 per cent of the manufacturing sector, but, nevertheless, during this period the growing manufacturing industries created employment for more than 600,000 people, roughly 25 per cent of the increase in the total United States working population during the same period. It does seem for this reason it is wrong to maintain that only the service sector merits study because it is the only growing one. The manufacturing sector is stagnating because it consists of fast growing and rapidly declining sectors, of about equal importance in terms of employment. The tendency to regard the service sector as the only growth sector in the economy of the western world is both confusing and misleading. The industries to be studied in this report can be considered as real growth industries in this respect.

Naturally, area redevelopment policy should take account of the possibility of attracting service-activities. For example, many depressed areas have already profited from scientific and industrial research activities newly located in the area, although these activities usually require a large proportion of very highly-skilled employees, seldomly available in the area in question. An active area development policy however should explore any avenues which might contribute to the growth of welfare in the area.

Certainly, studies about the locational requirements of such rapidly growing service-activities as research and tourism would seem worthwhile. However, it would appear that no standardized method of analysis can be developed for this purpose since the requirements of these activities are too diverse, and, therefore, separate studies for each activity will be needed. An example of a preliminary study of this sort is provided by the proceedings of a conference on the research industry, held in Maryland in 1963. The views expressed at this conference, about the locational requirements of the industry, were of a general nature. Reference was made to the need for contacts with a university, pleasant living conditions and, as far as research in biology and physics was concerned, pure air and water resources. More systematic studies of this subject are now being made[1], although the locational requirements they refer to are either vague or so demanding that only few places, even in the United States, can provide them. For example, a recent address by Dr. Jerome B. Wilmer, special assistant to the President for science and technology, contained a list of eight factors that influenced the creation of the scientific complex round Boston: they are:

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[1] "*Sites for Science*". A reference study by Industrial Development and Manufacturers Record, Industrial Development August 1964. Atlanta, Ga. Also discussions and attachments in *Technology in the Nation's Economy*, 1965, page 68 Also "*Sites for Science*", 4th Annual Reference Study, Industrial Development and Manufacturers Record, August 1965, page 9.

1. The presence of outstanding scientific schools and faculties,
2. Government sponsored research activities,
3. A supply of skilled manpower,
4. A diversified supporting industry,
5. Readily available capital,
6. Good transportation,
7. Pleasant living conditions,
8. Some very good luck.

Conditions for the development of tourism are of a completely different nature. They include natural attractions and touristic facilities, a nearby larger urban agglomeration, the accessibility of the area's natural attractions and transport facilities between the area and the agglomeration. Professor Fred E. Case of UCLA has carried out some pioneer work in the evaluation of the relative attractiveness of different touristic resources. At the Netherlands Economic Institute an attempt has been made to determine the economic importance of water-recreation[1]. No systematic study of the field is known to the author. Whilst such individual studies of service-activities are important, they lie outside the scope of ours.

The industrialization policy must be based on a reconciliation of, on the one hand, the industrial structure and the human, social and natural resources of the area, and, on the other, the locational requirements of the industries to be attracted to the area. Clearly, locational requirements of any industry chosen at random will be largely independent of the structure of a similarly selected area, although adjustments are possible within certain limits. It is not desirable therefore, for each area to study separately the locational requirements of all industries. There is a need for such research to be centralized, and the results made available to all areas pursuing a development policy. In this study only three industries have been considered in detail. It is clear, therefore, that only limited conclusions can be drawn from the results of the study. In order to provide local governments with full information on the locational requirements of industries central governments should apply systematic studies to *all* industries.

The task of the local government will then be to combine the results of this research with its own intimate knowledge of the area, in order to draw up a programme of action to attract these industries that could profit from location in the area which, in turn, could make a sizeable contribution to the growth of the area. The methods by which these industries may be selected are examined, in a general way, in Chapter 3. More detailed *feasibility studies* will have to be made, preferably in co-operation with industry experts, in order to reach more detailed conclusions about specific activities. This last point is of particular importance, for,

"... industry covers an enormous range of activities, finely differentiated, one from another. Economists are accustomed to very broad categories and are inclined to make abstraction from the fact that these categories include thousands of individual activities, with specialization extending down to small-scale and large-scale production of component parts"[1].

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[1] This study is similar to the one made by the Area Development Administration: ARA Casebook No. 11. U.S. Dept. of Commerce "*Economic Impact of Schweitzer Basin Ski Resort*", Sandpoint, Idaho. October 1964. In both studies an attempt is made to estimate the economic importance to the area of tourist expenditures and their growth, and of the income which would result from improved conditions for tourism.

The *programme of action* constitutes the follow-up of the feasibility studies and the general framework of the local industrialization policy. It should contain useful, precise and correct information about the area which is *relevant* to the industry in question. It should show clearly the extent to which the local government is willing to participate, one way or another, in the new activities and, in general, to meet any special requirements the industry might have. It must be formulated and implemented by professional people who know both the area and the industry and who realize that their actions are supported both by the results of sound studies and the enthusiasm of the local government authorities as representatives of the area's community.

A few remarks about the "local government" are required before this section is concluded. So far we have assumed that the area "to be industrialized" or "to be developed" possessed its own local government; in other words, that the administrative boundaries of this government coincided with the area to be developed. However, this is not normally the case. Municipalities or counties in many countries are so small that the depressed area may contain many such units. In these circumstances, efforts for redevelopment evidently need to be the result of a concerted action on the part of all the local authorities that have an interest in developing the area.

Unfortunately, actual practice does not adhere to such a logical framework. Even in cases where various municipalities do co-operate in formulating a common policy or a regional masterplan, jealousy frequently becomes chairman of the meetings: communities where industry should be concentrated believe that workers in its industries should be housed in residential districts within its boundaries; municipalities possessing unique opportunities for residential developments look for employment opportunities for their population; and communities with good sports and recreation facilities feel that their populations should expand in order to provide the financial base necessary for their development. In the Netherlands, where municipalities are relatively small and local pride is strong, virtually all municipalities strive for the same objective: to have as much as possible of everything within their own boundaries. The result is that the total acreage of municipal industrial zones in the Netherlands considerably exceeds the need for industrial land for many years to come, recreation areas are small and scattered over the country and regional plans in which more than two municipalities are involved fail one after another. All this is done in the name of "local pride".

Concerted action for the benefit of a larger area will be difficult and complicated as long as the income of a local authority depends on the size of its population and/or industry. But a solution to this problem must be found. If the potential results are in the interest of the whole, larger area, then the secondary interests of the smaller areas should be treated as such, and local authorities be made to realize that their communities will benefit more from a common effort than from isolated actions.

1.6. GENERAL INSTRUMENTS USED IN INDUSTRIALIZATION POLICY

This study is concerned with methods of industry selection that may help local governments to attract those industries for which the economic structure, the geographic position and facilities offered by the area seem particularly favourable. Such an industrialization policy is therefore very selective, since only certain, specially chosen activities are sought after. Nevertheless, many areas also pursue a more general type of industrialization policy, which provides for the use of more general instruments for attracting industry. It is useful to describe such general policies at the outset, in order to portray the background for the selective policies to be discussed later. The instruments prescribed in general industrialization policies can be financial or non-financial in character.

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[1] LEO H. KLAASSEN, op. cit.

Financial instruments comprise low interest loans for newly locating industries, guarantees of interest payments, and subsidies in land and building costs. Usually, the more labour-intensive the industry, the greater the subsidy offered; this is logical since their purpose is to stimulate the creation of jobs. In many countries some development areas receive subsidies from the central government, as well as from the local authorities. In a few countries, including Holland, local governments are not allowed to grant such subsidies which, therefore, are limited to the "nuclei" in the development areas.

Although such financial incentives are available to any industries locating in the area if they fulfil certain conditions connected with the number of workers employed, and general economic viability, there is, in effect, an implicit selection process. First, those industries which are labour-intensive industries are favoured; indeed in many countries capital intensive industries may receive no subsidy whatsoever. Furthermore, the financial assistance is usually greater where building costs form a high percentage of the venture since, in most cases, the subsidy is related to building costs. However, the selection process remains very general in character since all labour-intensive growth industries, and not specific ones in this category, are sought after.

The *non-financial* instruments can be even more general in nature. They include road, railway and communications' improvements, as well as the development of residential schools, play-grounds, and shopping facilities etc. Broadly, they seek to improve the economic, social and cultural "climate" of the area in order to heighten its general attractiveness as an area for new activities. One instrument that deserves special attention in the present context and one that is often used in connection with general infrastructural improvements, is the *industrial estate*:

> "One of the most significant developments in industrial organization in the present century is the increasing interest shown in many countries for industrial estates—a device which can take many forms, but which, basically, refers to a tract of land developed in accordance with an overall plan designed to provide accommodation for a sufficiently large number of factories to make it economical to provide common services and special facilities to the industrial occupants.
>
> An industrial estate can take many forms depending upon the range and type of industry involved and the particular requirements of the country or district in which it is situated. The benefits afforded by the availability of sites, factories and services on industrial estates are particularly important for small firms or new enterprises, especially those which can be accommodated in standard factory buildings offered for rent. The range of industries which can be so accommodated is surprisingly wide: it includes many branches of electrical and general engineering, food processing, furniture, clothing, textiles, plastics and many others. Sites on industrial estates are also suitable for large organizations

desirous of setting up branch factories, distribution depots and factory units producing special components"[1].

The number of industrial estates in developed countries has rapidly increased in the course of this century:

"According to a survey made in 1957 of 302 industrial districts in the United States[2], 70 per cent were sponsored by profit-motivated private groups—industrial district corporations, railroads, industrial real-estate brokers, contractors, architects and landowners—24 per cent by non-profit community organizations—industrial foundations, chambers of commerce, redevelopment and housing authorities, development commissions—alone or in co-operation with others, and 6 per cent by local governmental agencies—county or municipal governments and port and airport authorities"[3].

In mid-1960 the number of industrial estates in the United Kingdom (where the first estate was established at Trafford Park, Manchester in 1896) was 33, located in South Wales and Monmouthshire, Merseyside, West Cumberland, the Scottish development area, the North Eastern development area and Northern Ireland[4].

In Italy, where the industrial estates are being used intensively as tools for the industrialization of Southern Italy, by August 1957 nine large industrial estates has been provided, varying in size from 750 acres (Bolzano) to more than 2800 acres (Maghera, Venice), 41 factories were located on the Bolzano estate and 208 on Maghera[5].

Since the nature and lay-out of an industrial estate depends largely on the type of industry that locates there, it is rational to study the characteristics of these before designing the estate. In this context it is illuminating to quote from the Report on the Village and Small-scale Industries (Second Five-Year Plan) of the Government of India[6]. Although the recommendations of the Planning Commission that presented this report relate to an underdeveloped country, they apply surprisingly well to the conditions obtaining in many developed countries. Furthermore, we should remember India has, at present, more than 120 industrial estates in operation. The recommendations are:

"In proposing schemes for developing various small-scale industries, conditions of demand, availability of raw materials and other relevant factors have to be studied carefully. It could be useful to select for different regions the industries for which favourable conditions exist and which would, therefore, be specially promoted and assisted. In preparing departmental schemes and in scrutinizing the applications from private persons for loans and other assistance, reference to lists of selected industries could be of much assistance. Exploratory surveys as well as intensive studies are needed for their preparation and for the necessary modification in the light of changing conditions. A programme of investigations has already been initiated by the Small-scale Industries Board and a team has completed reports on four industries in the northern region, namely, sports goods, sewing machines and parts, bicycles and parts and leather footwear, and one industry on an all-India basis, namely automobile batteries for the northern region. Similar teams for the eastern, southern and western regions have also started working. Pending the completion of these studies, tentative lists of industries could be drawn up by State Industries Departments on the basis of their own experience and judgement, so that a measure of direction and guidance can be given to developments in this field".

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[1] G.G. LANHAM, *Problems in establishment of large-scale industrial estates*, Industrial estates in Asia and the Far East. United Nations, New York 1962.

[2] William Bredo, Industrial Estates—Tool for Industrialization, Glencoe, Illinois, 1960.

[3] Establishment of Industrial Estates in Under-developed Countries, United Nations, New York 1961, page 4.

[4] Ibid, pages 6/7.

[5] Ibid, page 12.

[6] New Delhi 1955, Chapter XX, paragraph 48.

The Establishment of Industrial Estates in Under-developed Countries[1] contained the following comments on the above paragraph:

"Determination of the appropriate types of enterprises is obviously called for at the time an estate for small industries is planned, if relationships of interdependence and complementarity are to be established among occupants, or between them and large industries, and if common services are to be provided by them economically and efficiently, as recommended by the Planning Commission. The Commission's policy involves considerably more planning and research work for establishing industrial estates than is usually done in the developed countries. Determination of the appropriate types of industries would be based on a survey of needs and potentialities in the area, and would influence the location, size (allowing for possible future expansion) and industry composition of the estate. It would affect the type and size of pre-constructed factory buildings and indicate the need for special installation, for instance, railway sidings rather than, or in addition to trucking facilities. It would also affect the type of common facilities to be established on the estate. Setting up workshops for forging, casting, case hardening, enamelling, electroplating, heat treatment, metal testing, dyeing and others would be justified only if sufficient demand for such services permitted costs to be cut through economies of scale. The main advantage expected from inter-servicing and inter-trading among occupants is a reduction of production costs. This cannot be obtained by occasional job lot orders, but requires a stable and adequate volume of demand. Investigation of the type of industries is also useful if co-operative organizations for procurement of raw materials or marketing of finished goods are to be established.

In practice, implementations of the Planning Commission's recommendations met with difficulties. A survey team appointed by the Committee on Plan Projects of the National Development Council to evaluate factory building projects in industrial estates reported that, in the estates it had visited, only "preliminary surveys of a very limited character appeared to have been carried out, more from the point of view of making an assessment of the potentiality of finding suitable tenants than for the purpose of ascertaining the type of new entreprises or industries that could be established to ensure co-ordinated development as envisaged in the plan"[2]. In many cases, the estates were planned on the basis of requirements expressed in applications which small entrepreneurs were invited to submit as soon as the decisions to set up the estates were taken".

In these quotations there is a clear statement that industry-selection prior to the establishment of an industrial estate is a necessary condition for its successful operation. In the present context the most important implication of this is that, in this way, the industrial estate links a general and a selective policy of industrialization. This is not true only of large industrial estates; it

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1. Op. cit., page 20.
2. Government of India, Committee on Plan Projects. *Report of the Selected Building Projects Team on Industrial Estates*. New Delhi 1959.

is equally valid that industrial areas or zones of a more limited scope need to be planned in advance and thoroughly prepared for industrial occupancy. Industry-selection is a basic starting point for such planning and will receive due attention in the following chapters.

Chapter 2

TYPES OF INDUSTRIES TO BE STUDIED

2.1. INTRODUCTION

The first question about industrialization policy is which types of industries should be sought after. This question will eventually be explored in detail; at this stage it is sufficient to note that, not unnaturally, local governments will be interested in industries that are both growing, and labour-intensive or labour-oriented. The attraction of growth-industries simply reflects the fact that the faster the growth of an industry, the more new locations there will be and, therefore, the greater the probability that one of these locations will take place in the area.

Labour-oriented industries receive attention since the area's interest is to employ or re-employ as many workers as possible. Yet, the greatest impact on employment is not necessarily caused by labour-intensive, growth industries. For a firm's *direct* impact on employment in the area is not the major consideration, but its influence on *total* local employment. This total effect comprises the new employment created by the firm and also the employment created indirectly in other branches in the area. Applying to this problem a distinction between basic and non-basic industries[1], the new industry is a basic industry giving rise to secondary employment in non-basic industries; on the average, this is estimated to be about equal to the initial employment—that is, the employment multiplier is two. In this case, the total employment created directly and indirectly by the basic firm is proportional to the employment of the basic firm itself. Therefore, the more labour-intensive the selected industry, the greater the rise of total employment in the area.

However, in addition, a basic firm can influence the level of employment in others and such reactions *within* the basic sector itself should be also taken into account. In order to estimate the indirect influences we would need an input-output table for the area and, in addition, be obliged to make several very rigid assumptions to obtain an approximation to the additional employment created in linked activities. Another method that seems to be, given absence of regional input-output data, a more realistic approach is to estimate the limits between which additional employment in linked activities might lie. A maximum could be calculated on the basis of the national input-output table, a minimum taken at zero. If the maximum appears to be relatively low compared with the initial employment—and this may often be the case—50 per cent of this could be taken as an estimate. If it tends to be high, further attention should be devoted to both the industries in which the secondary employment is being created, and their relative importance in the area. The result of such an examination will usually be that the secondary employment created in other basic industries is of relatively minor importance compared with the initial employment. Therefore we will concentrate our attention on the size of the initial employment.

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[1] A basic industry is defined as an industry that is *able* to export outside the area. This definition implies that not only firms exporting to other areas but also firms replacing imports are considered basic. Thus, if a firm supplies the local market with products that would otherwise have to be imported, it is considered to be a basic firm. Non-basic industries are industries which are unable to export their products to other areas. It follows from this definition that a method which seeks to determine the extent of basic activities by estimating exports is inappropriate. Clearly the categories are different for different sizes of the area. For a discussion of this concept see W. ISARD, *Methods of Regional Analysis, an Introduction to Regional Science*. New York-London 1960, page 189 ff. It might be that this work does not give the import substituting activities the attention they deserve. In the above definition, which seems to be the most rational one, they are treated symmetrically with export activities. See also: L.H. KLAASSEN, L.M. KOYCK and D.H. VAN DONGEN TORMAN, *Hoofdlijnen van de sociaal-economische ontwikkeling der gemeente Amersfoort van 1900-1970*, Leiden 1949, page 69 ff; and LEO H. KLAASSEN, *Area Economic and Social Redevelopment*, OECD Paris 1965, page 76.

Thus, labour-oriented growth industries are, from the area's point of view, the most interesting type and local policy should be directed at attracting them. In order to make such a policy as powerful as possible, an attempt should be made to compare the economic and social structure of the area with the requirements of these industries. In this connection, we have already considered the socio-economic structure of the region. This and the following chapters will be concentrated on the locational requirements of labour-oriented growth industries. However, at this stage, it is useful to explore certain preliminary considerations about rather general concepts.

However, one point must be emphasized at the outset. Although our selection will be based on national averages, account should be taken of the fact that industries might stagnate in one area and, simultaneously, expand in another. As long as locational requirements change so will the pattern of location. Thus, the level of employment in the textile and leather industries may remain stable or even decrease whilst their locations may be shifting from high to low-range areas. They might be declining industries in one area and growing industries in another. For this reason area development policies might sometimes be successfully concerned with industries which, at the national level, are stagnating or even declining, but which have something to offer of importance for the areas to which they are tending to move. The most promising long-run oportunities, however, are naturally associated with industrial activities the national demand for which is expanding and may be expected to do so for a long time to come. They provide a firmer basis for area industrialization policies than stagnating or declining industries.

2.2. THE IMPORTANCE OF LOCATION: THE CONCEPT OF "FOOTLOOSE INDUSTRIES"

An entrepreneur's choice of a location for his firm is probably one of the most important he ever will make. Not only does it fix the location from where he is henceforth obliged to purchase his raw materials, semi-finished products and energy, hire his workers, and sell his products etc., but, even more important, he knows that, once located in a given place, the costs of moving to another spot are so high that, no matter what its advantages, the financial consequences of a move would probably force him to stay put.

In the Weberian analysis[1], the optimal location is determined by the principle of minimum transportation costs. Other considerations such as the proximity of a market and its influence on the size of the firm and labour costs, are all treated as causing greater or smaller deviations from the optimum calculated from transportation costs only. Hoover modified this theory by introducing "the localization economies" that result from the presence of firms technically associated with the one in question[2].

Clearly the applicability of this theory is rather doubtful in the case of industries in which physical transportation plays a minor role. For these industries a more relevant theoretical starting point is required. This applies "a fortiori" since the decline in recent years in the importance of transportation costs in the locational requirements of industries even those for which such costs used to be a basic consideration. Currently, and perhaps to an even greater extent in the future, many industries have become "footloose" in a sense that their location in the different areas of a country gives rise to only minor differences in production and distribution costs.

"Most metropolitan areas in the United States today offer conditions for the location of economic activity that are, to a large degree, equivalent. Except for first-stage resource users—such as lumber and mill products, certain construction materials, and petroleum refining industries—the bulk of American manufacturing is free to locate almost anywhere. Production costs, it may be estimated, probably vary by less than 10 per cent among alternative locations, and even this small difference may be declining. The national market is becoming increasingly accessible from all potential locations and external economies can be obtained on practically the same scale in all of the larger metropolitan regions"[3].

Luttrell came to a similar conclusion[4]. He estimated that about two-thirds of British industry could be considered "footloose".

It is useful to examine the above quotation in some detail and, at the same time, to give further consideration to the concept "footloose"[5]. Let us start from the definition that *an industry is footloose if its long run profitability is the same for any location in an economy*; profitability is here defined as the profit margin. This definition seems efficient since the entrepreneur is basically concerned with the *long-run* profitability of his firm. As already pointed out, his decision to locate in a given place is such an important one that he must give serious consideration to the likely long-term developments of locational conditions at different places.

A first comment on the quotation therefore is that it does not seem appropriate to evaluate alternative locations only on the basis of costs. There are two important reasons for this. Firstly, with a given level of costs, revenues might differ considerably between alternative locations on account of variations in the size and structure of the markets and in elasticities of demand. To supply a product to one market might give quite different revenues from those obtained from another. In addition, a 10 per cent difference in costs can have a magnified effect on profitability. Let us assume two firms, both selling the same product for a price of 100 units, but with unit costs in one case equal to 80 units and in the other 90. Then, the profit margin in the first firm is 25 per cent and in the second only 11 per cent.

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[1] A. WEBER, Uber den Standort der Industrien, 1. Teil, Reine Theorie des Standorts, Tübingen, 1909.

[2] See E. M. HOOVER, *Location Theory and the Shoe and Leather Industries*, Cambridge, Mass., 1923, page 90: E. M. HOOVER, *The Location of Economic Activity*, New York 1948, page 43 ff; and B. OHLIN, *Inter-regional and International Trade*, Cambridge, Mass., page 203.

[3] JOHN FRIEDMANN, MIT Regional Development in Postindustrial Society: Some policy considerations. *Nations Manpower Revolution 1964*. Page 2333.

[4] W.F. LUTTRELL, Factory Location and Industrial Movement, London 1962.

[5] This concept is also examined in Chapter 7.

Furthermore, even if unit costs were exactly the same throughout the nation, we should realize that this reference would be to total unit costs and not each item separately. Clearly, the latter could not be equal since, for example, wages are higher in large cities, transportation costs in remote areas, and landprices in densely populated areas. Evidently, therefore, the statement that an industry is footloose means that, with revenues equal, the sum of all these unit costs elements does not differ significantly from region to region. But such costs elements as those connected with transportation, wages and land are not constant over time. Real transportation costs are declining, wages are increasing, land values are rather stable in some areas and increasing rapidly in others. Therefore, to assume that the sum of all these costs will also not differ between regions, in the long run, requires that the *rate of increase* of all these costs elements be the same in all regions. It can readily be demonstrated that this is not the case and, therefore, it follows that an industry which is footloose now need not necessarily be so in the future.

A third comment on the above quotation is that not all factors which play a role in the location decision can be quantified, certainly not by measuring cost levels. We have stated that the location decision is influenced by revenue considerations as well as costs, but other factors also play a role, if not always a completely rational one, and affect the decision in a systematic way. These influences are not those that derive from the preferences of entrepreneurs and their wives for their nature region; such considerations play a role, which is random, not systematic. Rather do we have in mind at this stage the tendency for many industries to concentrate in or near larger metropolitan areas. This can partly be explained by such factors as the proximity of the market and easy contacts with technically related firms. The evidence reveals however that other factors of a non-economic nature also play a role. The whole cultural and social life of a city—the nature of the shopping facilities for example—seem to exert such an influence on almost any entrepreneur, his family and his staff, that we will have to take serious account of factors like this. An implication of this is that a statement to the effect that a certain industry must be footloose *because* cost levels do not differ very much between areas, is not necessarily true. It may not even be valid if it could be shown that its profitability does not differ between areas. And it certainly does not hold simply because transportation cost differentials have dwindled in importance; in such a case the only conclusion that could be drawn is that the industry has become footloose *in so far as transportation costs are concerned.* This could mean that factors other than transportation have become relatively more important, and that the industry is not at all footloose in a *general* sense.

Finally, we should remember that, since countries vary a great deal in size, an industry might be footloose in one (small) country but not in another (larger) one. We will return to this point at a later stage[1]. It suffices for the moment to state that the footloose concept should always be qualified with respect to the dimensions of the *region under consideration.*

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[1] See example given in Chapter 7.

In conclusion, it is obvious that we will have to handle the concept of "footloose" industries with great care and should not interpret it in a short run, static and purely economic way. We will return, frequently, to this concept in the course of the study. In the author's opinion, the most fruitful approach to the question is to consider all locational requirements, including those of a non-economic nature, and not to regard almost any industry as footloose simply because differential transportation costs, for example, have become of negligeable importance.

"It seems to me that the term 'footloose industries' has something of a negative or defeatist connotation, which of course may be justified in the light of the present state of formal theory. I would argue that it does not mean that the locational choice of these industries is random or a matter of no consequence, but simply that we do not yet have adequate data and analytical tools for taking into account the factors that do constrain the location of these types of industry. 'Footloose' tends to be a catch-all term"[1].

2.3. THE DEFINITION OF LABOUR-ORIENTED INDUSTRIES

In order to define what is meant by the term labour-oriented industry, first we will consider labour costs in a term as a proportion of total costs. By definition, the total cost of labour to an entrepreneur is equal to the wage rates paid times the number of workers he employs. Depending upon the nature of production process in a given industry, this wage-sum will form a fairly constant proportion of total value added by the firm or it can be varied. Where the nature of the production process allows units of capital and labour to be fairly easily substituted for each other, this proportion is likely to be kept fairly stable on account of the manner in which the entrepreneur reacts to changes in wage rates. Where the wage-level in a given region or country is relatively high, he adjusts the number of workers employed accordingly and uses capital-intensive methods. Where the wage-level is relatively low, he uses more labour-intensive methods. Such compensatory adjustments are important in road-building, agriculture and construction activities, for example. For all practical purposes it may be assumed that the ratio of the total wage bill and net value added is independent of the wage-level[2] for certain industries and, furthermore, for some industries it may be very similar. Thus, for industries where factor substitution possibilities are good, this ratio is unsuitable as a measure of labour-orientation.

The situation is different where little or no such substitution is possible, that is where capital and labour are used in a fixed, or almost fixed, ratio. There are indications that this is a feature of many industries. The very capital-intensive oil-industry is a good illustration. A refinery is very much the same whether it be in the United States, Europe, Africa or Asia. Very large amounts of capital per worker are invested, completely independent of the wage-level.

Service industries provide many examples of labour-intensive activities where the ratio between the amounts of labour and capital employed is more or less fixed; restaurants, barber shops, theatres, scientific research institutions, etc. may show a tendency to become more capital-intensive with time, but, in principle these changes can be considered to be of minor importance. Examples in the manufacturing sector are the transportation equipment, leather and lumber industries. In this report the latter group of activities is of great importance. Their manpower requirements are such that in some cases special skills are needed, and, in others, only low-skilled workers. Their profitability is usually heavily influenced by the wage-level, on account of the lack of substitution possibilities. Such labour-intensive activities will be the subject of our study.

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[1] Edgar M. Hoover in a letter to the OECD Paris, 14th September, 1965.

[2] For the proof of this in the case of the Cobb-Douglas production function, see Mathematical Appendix 1.

2.4. THE CONCEPT OF A GROWTH INDUSTRY

The size of an industry can be defined and measured in several ways; the one selected will be the most appropriate for the purpose in hand. In this section we will decide which measure should be used for studying the locational requirements of labour-oriented growth industries.

The most important macro-economic aspect of an industry is its contribution to national income. For this purpose the total value added is the best measure of its size. Using this criterion, a *growth* industry would be one for which the total value added, measured in real terms, increases more rapidly than that of total industry (or of total national income), a *stagnating* industry one for which value added increases but less than that of all industries taken together and a *declining* industry one for which value added decreases absolutely over time. Clearly, this way of measuring the size of an industry is the most general one. Value added includes by definition the contribution of labour, and of capital and profits.

However, in the present study a different criterion seems more suitable. This is made clear by an example. In the textile industries of many western countries, total production is increasing but employment falling. The same is frequently true of the food and beverages industry and coal mining. Some Dutch figures reveal this[1].

There is no doubt but that the growth rate of the industry is important in this context. In an industry where output is constant, any mechanization project

TABLE 2.1. RELATION BETWEEN PRODUCTION AND EMPLOYMENT IN THE NETHERLANDS' MANUFACTURING SECTOR

INDUSTRY	AVERAGE ANNUAL INCREASE IN PRODUCTION IN PERCENTAGES		AVERAGE ANNUAL INCREASE IN EMPLOYMENT IN PERCENTAGES		ELASTICITY OF EMPLOYMENT WITH RESPECT TO PRODUCTION	
	1950/56	1954/60	1950/56	1954/60	1950/56	1954/60
Chemicals	7.3	7.7	4.7	3.4	0.6	0.4
Metal	9.4	9.3	4.3	2.3	0.5	0.2
Textile, clothing	4.8	3.1	−0.5	−0.3	·	·
Food and beverages	3.5	4.1	−0.1	−0.6	·	·
Earthenware	4.2	3.7	1.1	1.0	0.3	0.3
Leather and Rubber	4.0	4.5	2.3	1.5	0.6	0.3
Paper	6.3	6.8	1.5	1.4	0.2	0.2
Construction	6.4	5.0	3.9	2.9	0.6	0.6
Mining	0.7	2.9	2.8	−0.6	·	·
Gas; electricity; water	8.3	6.8	1.4	1.3	0.2	0.2

· = not calculated.

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[1] Source: *Centraal Economisch Plan 1961*, page 78. Central Planning Bureau, The Hague, The Netherlands.

will lead to an absolute decrease in employment. In a very rapidly expanding industry, however, even heavy mechanization might not cause such a decrease. In the Netherlands this seems to have happened in the gas, electricity and water industry where production during 1954-1960 increased considerably (7 per cent annually), so that despite heavy mechanization, employment rose by 1.3 per cent annually during the same period.

For two reasons changes in the number of workers employed will be taken as the measure of the growth of an industry in this study. Firstly, we will be mainly concerned with industries in which there are limited possibilities for the substitution of capital and labour. This means that output per worker is, roughly speaking, proportional to the number of workers. Secondly, we are more concerned with an industry's demand for labour, than with the size of its production. However, in addition to rates of expansion of the labour force, attention will also be paid to production levels.

2.5. THE CHOICE OF THE LABOUR-ORIENTED GROWTH INDUSTRIES[1]

These criteria will be applied to United States manufacturing industries' data in order to discover three examples of manufacturing industries that are both labour-oriented and growing. Labour-oriented industries are considered as those having a high payroll in relation to value added. Table 2.2 contains data taken from the 1958 Census of Manufactures; the total number of employees in 1958 and 1954, and the *wage quota* (defined as the ratio between payroll and value added) are given. It can be seen that there are very considerable differences between industries in both growth rates and wage quotas. Growth varies from −17.6 per cent for Miscellaneous manufacturing to +33 per cent for Rubber and Plastic products n.e.c. The wage quota varies from 20.8 per cent for Tobacco Products to 60.5 per cent for Textile Mill Products. A more systematic classification on the basis of the two criteria is given in Table 2.3 Growth industries for the purpose of this table are defined as those industries that expanded between 1954-1958 at more than 5 per cent per annum; labour-intensive industries as those with a labour-quota of 50 per cent or more.

The branches of industry studied later, will be chosen from these industry groups. We should realize however, that, although an industry becomes more homogeneous the more narrowly it is defined, for a given size of region considerably less data are available for such smaller branches. This reflects the fact that the Census Publications cannot publish information which could be identified with individual firms and the absence of data pertaining to smaller branches in input-output tables. Thus, it can be that if we prefer to examine more homogeneous industrial activities the analysis may need to refer not to states, but to wider geographic regions; this, in fact, proves to be necessary for the three chosen industries. In short, we must compromise between the optimum of the homogeneity of sub-groups and the availability of data, and the use of geographic divisions as regions is determined by lack of data rather than by preference. This compromise seems to be best with one more digit of the Standard Industrial Classification, though even these three digit-industries are too narrowly defined for a proper analysis of the labour-orientation of the industries.

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[1] For details on growth of United States industry groups see: *Growth and Labor Characteristics of Manufacturing industries*, United States Department of Commerce. Area Redevelopment Administration, October, 1964.

The following industries are chosen for the later analysis:

1. *Electronic components SIC 367*

   Comparable data 1954 not available.
   Industry group Input-Output Table 1958, Department of Commerce No. 57.

2. *Instrument and Related Products SIC 38*

   Industry group Input-Output Table 1958, Department of Commerce No. 62 and 63.

   From this group will be chosen the Input-Output Table group 63, Optical, Opthalmic and Photographic Equipment (consisting of the SIC groups 383, 385 and 386).

   And, in order to include an industry with a very rapidly growing labour force, but a somewhat lower labour quota, the following is also examined.

3. *Glass and Glass Products etc. SIC 32*

   From this group will be chosen Industry group Input-Output Table 1958, SIC 321, 322 and 323, glass and glass products, Department of Commerce No. 35.

TABLE 2.2 GROWTH OF TOTAL NUMBER OF EMPLOYEES AND WAGE QUOTA OF MANUFACTURING INDUSTRIES[1]

INDUSTRY GROUP	TOTAL NUMBER OF EMPLOYEES 1958	IDEM 1954	GROWTH	GROWTH IN %	WAGE QUOTA (PAY-ROLL: VALUE ADDED)
All industries	15,995,814	16,098,653	−102,839	− 0.6	52.2
20. Food + kindred products	1,761,816	1,709,106	+ 52,710	+ 0.3	43.1
21. Tobacco products	91,856	100,466	− 8,610	− 0.9	20.8
22. Textile mill products	916,987	1,049,900	−132,913	−12.7	60.5
23. Apparel + related products	1,187,840	1,195,779	− 7,939	− 0.7	59.7
24. Lumber and wood products	586,753	650,409	− 63,656	− 9.8	62.5
25. Furniture + Fixtures	350,585	342,443	+ 8,142	+ 2.4	59.1
26. Paper + Allied products	578,134	540,425	+ 37,709	+ 7.0	48.7
27. Printing + Publishing	872,502	808,945	+ 63,557	+ 7.9	56.5
28. Chemical and allied products	784,927	795,878	− 10,951	− 1.4	32.2
29. Petroleum and coal products	245,336	230,695	+ 14,371	+ 6.2	44.3
30. Rubber + plastic pr. nec.	335,655	252,456	+ 83,199	+33.0	52.6
31. Leather + leather products	359,107	365,334	− 6,227	− 1.7	60.4
32. Stone, Clay + Glass products	575,717	504,436	+ 71,281	+14.1	46.9
33. Primary metal products	1,135,577	1,187,127	− 51,550	− 4.3	54.0
34. Fabricated metal products	1,089,028	1,040,123	+ 48,905	+ 4.7	57.5
35. Machinery except electr.	1,385,494	1,573,851	−188,357	−12.0	58.9
36. Electrical machinery	1,198,926	1,004,532	+194,394	+19.4	53.9
37. Transportation equipment	1,635,881	1,765,891	−130,010	− 7.4	59.6
38. Instrument + related products	304,336	277,895	+ 26,441	+ 9.5	54.3
39. Miscellaneous products	579,357	702,692	−123,335	−17.6	60.0

[1] *Source:* 1958 census of Manufactures.

The description of the activities of these industries is given in Appendix I. The total number of employees in 1958 for groups and sub-groups is given in Appendix J.

TABLE 2.3 CLASSIFICATION OF INDUSTRY GROUPS

Labour quota \ Growth rate	Declining rapidly <−5%	Declining −5<0%	Stagnating 0−<5%	Growing moderately 5−<10%	Growing rapidly >10%
Low < 40%		21 Tobacco prod. 28 Chemical + All.			
Moderately Low 40−<50%			20 Food + Kindred	26 Paper + All. 29 Petroleum + Coal	32 Stone Clay Glass
Moderately High 50−<60%	35 Mach. excl. electr. 37 Transportation equipment	All industry 23 Apparel + rel. 33 Primary Metal pr.	25 Furniture Fixture 34 Fabricated metal pr.	27 Printing Publishing 38 Instrument. + rel. pr.	30 Rubber + Plastic 36 Electrical machinery
High > 60%	22 Textile mill 24 Lumber + Wood 39 Miscell.	31 Leather + L. prod.			

It appears that 4 industries fit the above criteria, and to these was added the Stone, Clay and Glass industry on account of its very high growth rate, although the wage quota was moderately low.

TABLE 2.4 LABOUR-ORIENTED GROWTH INDUSTRIES UNITED STATES 1958[1]

NO.	INDUSTRY GROUP	GROWTH RATE	LABOUR QUOTA
27	Printing and Publishing	7.9	56.5
38	Instrument and Related products	9.5	54.3
30	Rubber and Plastic products, n.e.c.	33.0	52.6
36	Electrical machinery	19.4	53.9
32	Stone, clay and glass	14.1	46.9

[1] *Source:* 1958 United States Census of Manufactures.

Chapter 3

METHODS OF INDUSTRY-SELECTION

3.1. MICRO AND MACRO APPROACHES IN LOCATION-THEORY; THE CONCEPT OF DISTANCE

The various approaches that are used in location-theory may be divided into two broad categories. The first category comprises analyses that seek to select the optimum location for an individual firm. These studies are normally undertaken from the point of view of the individual firm and necessarily result in a single, unique solution of the problem, the best point of location being indicated, to which all other solutions are inferior.

Clearly, such an approach is not suited to the present problem. Our concern is to determine how industries can be attracted to a given area and not to find the optimum location for a given plant in any area. Yet, to some extent, such micro-studies provide the basis for the type of approach which concerns us. This becomes clear if the problem is reformulated in a more aggregated way. Thus, instead of being concerned with selecting the optimum location for an individual firm, the question can be seen as one of determining the optimum distribution of all additional (or, a fortiori, of *all*) firms between the regions of a country.

Such a reformulation immediately emphasizes the importance of, for example, the size of local demand as a factor limiting sales of an industry, and of the limited local amounts of labour and raw materials as exerting a similar influence on the supply side. The usual way of solving the problem of the optimal geographical distribution of a given industry is to minimize the total transportation costs of both inputs and outputs, given the boundary conditions of regional demands and supplies and the local prices of raw materials and semi-finished products. A linear programming approach of this type results in a unique solution for the quantities to be produced in each area and for inter-area movements of the various items. This sort of solution is "normative", indicating what the geographical distribution *should* be. Typical of this approach is that contained in a recent publication in the series "Forschungsberichte des Landes Nordrhein-Westfalen"[1]. The author, Thoss, starts the study with August Lösch' words: "How are we supposed to support planning and improving, if we accept everything just as it is?"[2], revealing the characteristic attitude of such studies towards the problem. A (limited) number of factors are chosen and, on the basis of one simple assumption, namely that transportation costs should be minimal, the result is calculated and presented as the "best" distribution of the industry. In comparing such an optimum with the actual distribution of the paper industry in Western Germany, Thoss[1] concludes: "The inter-regional trade for all products is being maintained in an extremely irrational way"[2].

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[1] RAINER THOSS, "Die Standorte der Westdeutschen Papierindustrie", Köln and Opladen, 1964.

[2] "Wie wollen wir denn verbessern und planen helfen, wenn wir einfach hinnehmen, was ist?", A. LÖSCH. Um eine neue Standorttheorie. Eine Auseinandersetzung mit Ritschl, *Weltwirtschaftliches Archiv*, 54, 1941, II, page 8.

A considerable number of questions arise when this and other similar "programming" approaches are inspected. The most important is: If the actual distribution differs from the optimum one, what causes it to do so? Are factors other than transportation playing an important role? Does the organizational structure of the industry influence its geographical distribution? Have the location-factors changed recently? Does the age structure of the industry's buildings and equipment prevent a rapid adjustment to such changes? Does the quality of labour vary between regions? And, do communications with other stages of production play a more important role than questions associated with mere physical transportation would suggest? With answers to these questions, we would know why the distribution takes the form that it does and proceed to pose the next question: "Which factors determining this distribution will remain of importance and which will change?" Conclusions could be drawn about possible deviations of the actual and the 'ideal' distribution of the industry.

We do not wish to underrate the importance of the study made by Thoss or other similar ones. Thoss' study is an interesting one and the problem is posed and solved in an intelligent way. But its purpose seems rather limited and its results only partially relevant to our problem. The elements which need to be taken into account in the programming approach can only be derived from a study of the factors that are relevant to the location of the industry studied. To select only a few of these elements on the basis of a priori reasoning without testing their importance and ignoring the fact that completely different factors might even be considerably more important not only seems unrealistic but is almost certainly bound to lead to false conclusions.

The importance of this is appreciated when account is taken of the fact that recent developments in the manufacturing and services' sectors have to some extent been concentrated in activities where physical transportation plays but a minor role whilst "communications" in a wider sense have become increasingly significant. Banking activities, scientific research institutions, tourism and business services are four cases where the minimization of transportation costs does not seem to be a very relevant starting point for an analysis of the industry's regional distribution. The weight attached by the producer to contacts with associated activities might, in many of these cases, considerably exceed that of the physical transportation costs involved.

This is the core of the problem—the complex role played by distance in the location of industry. As far as physical transportation considerations are concerned, the impact on location is clear and measurable; the Thoss study provides a good example of the application of the transport-minimization criterion. Walter Isard's industrial complex analysis is another, more general, one. In his model both forward and backward linked production activities are shown to operate more economically in a single complex together with the major industry than if the various stages were spatially separated and unco-ordinated.

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[1] Op. cit., page 118.

[2] "Der Güterversand zwischen den einzelnen Regionen wird für alle Produkte ausserordentlich unrationell gehandhabt".

The importance of the costs of communications in a wider sense is less clear and certainly not as easily measured as physical transportation costs. A different approach therefore needs to be adopted.

It is assumed in this study that to the value of each inter-industry flow a weight can be attached which will not generally correspond to, and in many cases will even deviate considerably from, the weights corresponding to the physical transportation costs involved. Since these weights are not measurable in a direct way, an indirect method for their estimation has to be devised. This procedure is adopted for the following, in the author's opinion extremely important, reason.

The concept of the distance to be bridged in a physical sense does not in many cases coincide with the concept of distance that is implicitly or explicitly used by the entrepreneur. A given physical distance might correspond to a far larger economic and social distance for one inter-industry relation than for another. Costs made for bridging physical distance are called transportation costs, costs made for bridging economic distance will be called *communication* costs. For a producer of a given product three kinds of communication costs are important.

a) Communications with *other producers* linked either forward or backward to the producer in question. If physical distance between these producers and the one under examination decreases, communication costs will decrease in a direct, and an indirect, sense through faster service, prevention of longer stagnation in the process of production, quicker deliveries, easier contact on special requirements. There is also the possibility of holding smaller stocks, etc.

b) Communications with *consumers*. This is facilitated greatly by a smaller physical distance through better knowledge of the area and the characteristics of its population (habits, language, religion, special tastes, etc.), speedier information about changes in the market and its structure and a faster and more efficient reaction to these changes, and fewer possibilities of the misunderstanding of new developments, etc.

c) Communications with the *local government*. Better mutual understanding through more frequent and more personal contacts.

A common element in the communications with all three groups is the value of the time[1] involved in bridging the economic distance.

A study supervized by the author and E.H. Mulder of the Netherlands Economic Institute at Rotterdam[2] showed very clearly that Dutch international trade, especially for the more complex products was effected much more by economic and social distance than by the physical distance between the country in question and Holland. The distance elasticities of trade volumes measured directly were found to be —2.0, while distance elasticity derived from the price elasticity of the product and the share of transportation costs in the value of the product were —0.2. Thus, economic and social distance appeared to be, on the average, ten times as important as physical distance, and this effect is more pronounced in the case of complex than in the case of simple raw materials. Obviously, in the case of Holland or Europe, large distances usually imply language and religious differences, factors that might play only a minor role in the United States. But other factors and differences in habits and attitudes justify the assumption that even in the United States economic and social distances are more important than physical distances.

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[1] Credits Edgar M. Hoover.

[2] *De gevolgen van de realisatie van de Euromarkt voor de intra-europese handel*; Carried out by G.J. Aeyelts Averink, Rotterdam 1960.

In the opinion of the author this consideration is of great importance in understanding, not only the regional distribution of international trade but also of the interregional trade flows and, consequently, of the regional distribution of industries. Therefore, it is vital that it is kept constantly in mind when determining the chances of industrializing a given region. It means that impact of the spatial separation of activities cannot be measured by mere unit transportation costs, for which it is fairly easy to attach a weight to specific inter-industry flows. This weight alone does not reflect the true importance of the distance relationship; for this task we will devise a method in later chapters.

3.2. METHODS OF INDUSTRY SELECTION[1]

3.2.1. *General remarks*

We will assume that a region, carrying out an active industrialization policy, wishes to consider the possibilities of attracting an industry. Clearly, at the outset, this region would do well to look at its existing industrial structure from the point of view of a producer. That is, it should examine in detail the industries present in the region, both suppliers of inputs to, and potential buyers of products from, an industry to be attracted. The possible form of such a study will be examined, in greater detail, below.

First, however, it should be emphasized that the region should understand that it is competing for new industries with other areas, and that the entrepreneur looking for a site compares the advantages offered in one region with those of others. This implies that a given region should try to compete for those industries for which it is most suitable. However, for all regions to study all growth industries in order to select those for which they are best suited would obviously be a most inefficient procedure. The central government should, at least, coordinate any such studies, but, in the opinion of the author, one of the most useful contributions that the central government can make in this field is to provide the regions with full information about the locational requirements of all growth industries. The region would then need to compare its own structure with the requirements of the different industries, adjust this structure where possible and necessary and then take action to attract the most appropriate industries.

The type of study required from the central government will be indicated in the next chapters. They could and should be extended considerably by government officials to which more detailed data and better facilities are available than to the author. The results of such studies, for which government officials have access to more detailed information and better facilities than the author, should be readily available to all regions in order to help them to carry out a consistent and promising development policy.

A question that naturally arises in this context is whether or not areas pursuing a (re)development policy could not make use of the regional breakdowns of national forecasts. An example of a national forecast that implies forecasts for a number of regions is one that has been made on the basis of a *balanced regional model.* Walter Isard describes clearly[1] the workings of this model:

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[1] See: *How to Select Dynamic Industrial Projects*, International Cooperation Administration, Office of Industrial Resources, Washington 25, D.C., a manual which relates mainly to the selection of industries in underdeveloped countries.

"To illustrate the workings of a balanced regional model, imagine a three-order hierarchy of regions—nation, census region, and local area—and a corresponding classification of commodities—national, regional, and local. Given the final demand items for the nation as a whole, the outputs of national industries (industries producing national commodities) are determined in typical input-output manner by the use of an inverse matrix or a round-by-round iteration. Once the national outputs of those national industries are determined, a set of coefficients must be derived by which to allocate these national outputs among the several regions. These coefficients may be based on the geographic distribution of current production, on location studies, or on some other analysis. These coefficients remain constant throughout the operation. They are multiplied by the national outputs of national industries to yield for each census region the part of the output of each national industry to be produced in that census region.

To produce these outputs of national industries in each census region, inputs of both regional and local commodities are required. Utilizing national input coefficients, the inputs of regional and local commodities necessary to support the production of national industries in any given census region can be determined. All these inputs must be furnished by that census region, since by definition no regional or local commodity may cross a regional boundary, that is, be provided to one region by another region. In addition to these inputs of regional and local commodities, any given census region must furnish the part of the national final demand for regional and local commodities that is to be consumed in that region, since again regional and local commodities cannot be shipped from one region to another. But to furnish the region's share of final demand for regional and local commodities and the first round requirement of national industries for regional and local commodities, the producers in the given census region will require a second round of inputs of regional and local commodities, which round will lead to a third round, etc. The sum of these round-by-round and final demand requirements for regional and local commodities in the given census region can be determined either by the use of an inverted matrix or by iteration. This yields the required output of regional and local commodities for the given census region. Likewise for every other census region.

The next step is to subdivide each census region into a set of local areas. Then for each local area we determine:

1. Required outputs of *national* industries (through use of a set of constant coefficients based on the geographic distribution of current production, on location studies, or on some other analysis);
2. Required outputs of *regional* industries (through use of other sets of constant coefficients to allocate any given census region's outputs of regional commodities among its constituent local areas);
3. Required outputs of *local* industries (calculated in a manner similar to the way in which regional outputs of regional industries are determined for census regions)."

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[1] *Methods of Regional Analysis: an Introduction to Regional Science.* MIT—John Wiley and Sons. New York-London 1960, pages 346-348. For the discussion of the concept of national, regional and local commodities see also Chapter 7.

It would indeed be possible for a local government to use the results of these and similar studies when forecasting its own development. Although certain objections can be raised against the method, it is not obviously irrational to use such forecasts for the area in question in order to indicate the necessary preparations for the expected industrial growth in the sectors indicated. However, a basic assumption in the balanced regional model as well as in similar input-output models is that the allocation coefficients are fixed. This means that it is assumed that all regions will expand or contract outputs of any national industry proportional to changes in final demand. Such an assumption might hold good for large regions, less good for smaller regions and only to a limited extent for local areas. But this is not the main limitation. In the present context, the emphasis is on depressed areas that are trying to *change* their industrial structure. Forecasts derived from a balanced regional model might give rise to alarming conclusions that, if no action is taken, developments would be far from satisfactory. For prompting such action forecasts of this type may be helpful. But, except perhaps in the case of prosperous regions, they could never provide the sole basis on which local governments would be willing to base their policies. For, such policies must be active, in that they seek to attract new activities to the area and change the industrial structure fundamentally in a way that ensures a growth of local activities. This aim is incompatible with the assumption of fixed allocation coefficients. The forecasts may possibly be useful by indicating what the future picture would be if local government policy did not change, and thereby the targets which local government policy should pursue and the requisite changes. The greater the success of local policy in causing developments to diverge from these undesirable forecasts, the more effective the policy has been—and the effectiveness of local development policy is what we are seeking.

3.2.2. *The check-list approach; a passive method*

Before embarking on the examination of somewhat more complicated methods of industry selection the method of attracting industries to an area by publishing a list of facilities such as prices of utilities, labour, raw materials and the available facilities etc. in a given area in an attempt to attract the entrepreneur looking for a site merits a few paragraphs. Check-lists of this nature should be available for all areas in order to help the entrepreneur decide where to locate most advantageously. Such a check-list has been drawn up recently for Austria[1] as an instrument for promoting the optimum regional distribution of industry; in the Netherlands, the provincial Economic-Technological Institutes provide similar information, on demand, for the provinces and smaller areas. Although it cannot be denied that such check-lists are important and provide very useful information for the entrepreneur, for two reasons they cannot provide the only instrument for area redevelopment policy.

The first reason is that they include only certain types of information about the area. They give no hint about the area's imports and exports, nor of its total consumption of all products, data of the greatest importance for the entrepreneur who wants to know what he will be able to sell in the area itself and in the surrounding areas, the imports he will require and what can be bought locally. Since the check-list is usually very general in nature it fails to give the detailed information, pertaining to his industry, which the entrepreneur seeks. Secondly, the approach is essentially passive. With the check-list published, local governments must just sit back and wait for industries to come. This reaction is largely determined by the type of data which the lists contain. With more detailed studies, more precise information would come to light about the specific industries that could be attracted to given regions and the area itself could take the initiative and contact the indicated industries. In the absence of this information, the initiative is left to the entrepreneur—not the local government. Since the basis of area redevelopment policy should be that the area "must learn to view the creation, operation, and expansion of job-generating business-firms as something which can be accomplished by its own initiative, imagination and energy"[1], the mere publication of a catalogue location considerations is no more than the first step on the long road to success. It gives essential, but far from sufficient, information.

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[1] Katalog "*Standortfaktoren für die Industrieansiedlung*", Österreichisches Institut für Raumplanung.

"Every economic development group must be equiped with the means for finding and transmitting up-to-date economic information on available industrial sites, labour supply, freight rates, availability of water, and all the other data necessary to a first-class plant location service. In addition, the community must constantly be alert to the need for feasibility studies for prospective new industries, marketing analyses, and the collection and appraisal of other material essential to the establishment of new industries or the expansion of existing business"[2]. As will become evident, the contents of this report are a far cry from the necessary follow-up feasibility studies; the check-list approach however is even farther. Many additions will have to be made to the usual check-lists in order to endow them with more value for area industrialization policy. One of these additions is to combine them with the locational requirements for all specific industrial activities. There is also the comparative cost approach, examined in page 50.

An important example of a check-list that gives far more than most is to be found in the "1965 Site Selection Handbook" published by Industrial Development and Manufacturers Record in Georgia. Although also this list can only be regarded, from the area's point of view, as a passive tool, it contains so much information about an area, its economy, administration, taxation etc., *and the attitude of its officials* towards industrialization that it must be ranked half-way in between the normal lists and a more profound analysis of the area's economy. Because of the importance of this Site Selection Handbook we give the full contents of the 1965 issue in Appendix K.

3.2.3. *The experts' visit approach*

Perhaps the most simple active method for an area to select industries is the "brainstorming" or "experts visit approach". This is often used in the United States and a series of documents is available indicating the results of such visits. The principle of the method is very simple. A group of experts in various fields is invited to the area to meet the local government representatives and other local experts. In principle, the outside experts should not only have a broad knowledge of the general requirements of effective redevelopment planning but also experience in applying this knowledge to specific areas. The local experts, of course, understand the area, the attitude of its community and the industrial structure etc. In many cases, the combination of the two sets of knowledge, frequently for relatively short periods only, results in very useful proposals which, if studied further and elaborated can be of great value to the area.

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[1] *The community and... economic development.* US Dept. of Commerce. Area Redevelopment Administration, Washington, May 1964, page 10.

[2] Ibid., page 31.

The method has some obvious disadvantages. Perhaps the most important of them is that only in very few cases has a thorough and systematic study of the region been made and its contents communicated to all the experts before their meeting. This is a limitation even where the omission is due to the fact that the experts choose to rely entirely on their experience. Even in this case a systematic study could contribute to their knowledge and broaden their view. Of course any method that is applied or examined in isolation comes out badly, since combinations of two or more methods are frequently considerably more effective.

Another disadvantage of the method is that there is a danger—and the contents of several of the documents produced by such experts' groups in the United States attest to this—that the recommendations can be so vague and limited in number that, not only are they likely to be revealed as unsuitable, but, in the meantime, much time is lost in their evaluation which could have been used much more effectively in preparatory work for a more systematic (re)development policy.

The idea as such, however, is sound. In the author's opinion, only the application should be changed. Experts should be consulted right at the start of the active redevelopment policy not in order to obtain a blueprint for the redevelopment, but rather to suggest the most suitable systematic approach to the problem and to indicate to the local authority what needs to be studied and how it should be done. At the same time, the experts might draw attention to some improvements in the area that are immediately required, ensuring that both research and active policy could be started simultaneously in order to make most use of the time available.

Another improvement in the approach would be for the experts not to limit their participation to a single visit but to present themselves regularly in order to criticize the work done, give new suggestions and stimulate further research. Only if the local and external experts have the feeling of a common goal, for the realization of which they both are in a sense responsible, is there a real chance that some success will be achieved. Also, by this means, the impression will be avoided, that an area redevelopment policy can be formulated in a week by an expert. A series of visits from outside experts is obviously more costly than a single visit, especially if they assist in the study itself. But the returns will be so much higher for it that even those local authorities which are hesitant to spend money on anything (and there are many) will eventually admit that it was all worthwhile.

3.2.4. *The local forecast approach*

An approach that often is used in local economic studies that are to be the basis for development policy or a local or regional master plan, is to make a forecast of local industrial activities. Usually these forecasts are extrapolations of past trends in industrial activities, based on census data, information about relevant demand elasticities, labour productivity and current extension plans for local industries. The rationale of this kind of study is that the industries enjoying satisfactory development in the area obviously find themselves in a situation which meets their requirements. If this is the case, it is argued, other firms in the same branch might be persuaded to locate in the area. Therefore, measures to attract industries to the area should concentrate on firms in the most rapidly expanding industry in the area.

Any method of selecting those industries that might be attracted to an area should be based on a comparison of the area's existing structure and facilities and the requirements of the industries sought after, and an objection to the above approach is that the area's structure is only taken into account implicitly. That is, there is an implicit assumption that the area's structure is adequately reflected in, and represented by, the development of existing industries, and the possibility that this structure might be suitable for other industries is neglected. In any case, the area's industrial structure is usually not taken into account sufficiently. For the local industrial activities are extrapolated independently of each other, with usually only a distinction being drawn between basic and non-basic activities, so that neither now complementary opportunities arising from the growth of existing activities nor interdependencies between the latter are taken into account. Although it is true that, as already pointed out, the assumption of invariant allocation proportions is inadequate, local industry interrelations cannot be completely neglected.

The method does have some advantages. One is its simplicity. Another is that forecasts based on long-run observations frequently prove to be accurate. Nevertheless, the area might have potentialities not yet realized. These should be revealed, and a method based essentially on historical developments cannot do this.

A method that resembles the local forecast approach, but one which normally yields better results, is the type of survey that has been carried out for areas in the Netherlands and United Kingdom. These surveys are made either in preparation for a masterplan or as a first step in planning industrial development. Although the following description, taken from "The physical planning of industrial estates"[1], refers to the surveys made in the United Kingdom, its main features are also applicable to those made in the Netherlands[2].

"... today planned industrial development is normally preceded by a systematic survey. The nature of this survey is described here to indicate its importance and the benefits that would ensue if this type of planning and investigation preceded the huge investment which the location of an industrial estate entails.

The form of the United Kingdom survey varies greatly according to the type of area involved, the type of development proposed, the policy to be implemented and the nature of the sponsoring authority. Such surveys can be very extensive. In general terms, the scope of such an investigation would cover some or all of the following features:

1. A review of the economic and industrial structure of the area to determine its strengths and weaknesses. This would include an examination of the size, location and type of all industrial undertakings already in operation within the area as a whole, an appraisal of

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[1] United Nations, New York, 1962, page 15.

[2] Many of these surveys in the Netherlands are prepared by regional organizations (Economic Technological Institutes) and for several larger towns by the Netherlands Economic Institute, Division of Regional Economics.

their general potential, their present and future needs and their linkages with other undertakings.

2. An occupational and industrial analysis of the working population, with special reference to unemployment trends and to skill available.
3. A demographic analysis of the population within the area, to test what the future size of the local labour force is likely to be and how this compares with local employment trends and opportunities.
4. An examination of the transport network, with particular reference to industrial traffic and journey to work.
5. A review of public utility services, with special reference to their capacity to cater for industrial users.
6. A field survey of land availability to determine the location, extent and physical characteristics of all areas physically capable of industrial development, bearing in mind general planning policy and the needs of other types of use for both new development and redevelopment.

Local reviews of this type are undertaken by many of the larger local planning authorities in the United Kingdom as part of their development plan survey. When lack of personal time or facilities do not permit investigations on this scale, a modified survey along the lines indicated above should be considered essential for estate planning".

It can be seen that these surveys provide much better information than the local forecast approach usually does. Interrelations between industries are taken into account and the area's structure is described explicitly. However, the survey considers the development and potentialities only of existing industries, neglecting any promising new activities which are of fundamental importance in attempts to improve the structure of a depressed area. However valuable the area survey for many other purposes, normally it does not answer this, in the present context, vital question.

3.2.5. *The comparative cost approach*

In the comparative cost approach[1], a plant of given size, number of workers of different skills and needs for raw materials and semi-finished products etc., is assumed to take up alternative locations in different areas in order to determine where the lowest sum of production and transportation costs are to be found. In carrying out this kind of study for all industries and all areas the optimum distribution of the industries can be found and thereby which activities might be successfully attracted to a given area.

"Frequently the initial justification for one or more comparative cost studies arises because of changes in general technology, or in the technology of a particular industry, or in the production of an individual raw material or an intermediate good. For example, general improvement in a region's internal and external transport situation—the completion of a system of super-highways, the erection of more modern and efficient railroad terminal facilities, the construction of deep-water river channels, etc.—can have a significant effect on the relative advantages of the given region for industrial location. If the region is lightly populated with a plentiful variety and supply of natural resources, the transport improvement could tip the scales of regional advantage in its favour. Such improvement might give the region an advantage over locations using inferior or high-cost raw materials which had nevertheless *been* best because of nearness to markets. On the other hand, if the region itself is a densely populated market area, the transport improvement might drastically cut costs of assembling raw materials there. Thus, in certain heavy raw-material-using activities, such improvement would allow a shift in advantage from raw material regions to the region under consideration. In any case, because the transport improvement affects all industry in general, the regional analyst should pursue comparative cost studies for a number of industries".[1]

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[1] See i.a. W. ISARD, "*Methods of Regional Analysis: an Introduction to Regional Science*", New York - London, 1960, page 233 ff.

Isard's book contains some examples of comparative cost studies taken from the petrochemical, iron and steel and aluminium industries. It certainly is not by chance that all these are heavy basic industries. The present author, in co-operation with W.C. Kroft and R. Kattenwinkel of the Netherlands Economic Institute, made a similar study for a light metal industry; the results revealed that cost advantages existed in several areas where, in fact, the industry was unwilling to locate. It appeared that secondary location factors were so important that the actual distribution of industry diverged considerably from the theoretical. Clearly, such secondary factors are more important in the case of lighter industries than in the heavy industries examined by Isard, for which transportation costs are more decisive.

A considerable complication arises in comparative cost approaches connected with the size and location of the market. In the Dutch study the main market was concentrated in the Western part of the country near the larger cities, and if the market of the new firm is also in this part of the country, then the cost differences appear to be considerably smaller than if a more local market is assumed. This complication arises from the fact that an isolated firm and not the whole industry is being considered. For if we assume that a first firm locates at the optimum point, a second one would then be faced with changed conditions, since the market in the area where the first plant is located is now supplied. The problem of optimum distribution could only be properly solved by a macro-analysis.

Isard refers to yet another limitation of the method[2]:

"... in a comparative cost study for a given industry with reference to a specific region, both the price-cost structure and the magnitude of the market existing in each region are assumed given. Where the given industry is small and has little influence on income, demand, prices, and costs in any region, these assumptions may be justifiable. But such assumptions are clearly not warranted when the geographic pattern of the industry does have a marked influence on income, demand, prices, and costs in one or more regions. And certainly these assumptions are untenable when the researcher purports to analyze locationally each industry relevant for a region, since the estimated income and markets of the region and much of its price-cost structure is largely contingent upon the amount of industry to be located in a region".

The three points that have been examined suggest that the method may be very useful for some industries, particularly for larger, basic activities with high transportation costs, but that for other, lighter industries, for which secondary (communication) location factors are important it is less suitable. This is, in fact, the same objection we have raised against macro location theories that seek an optimum distribution of industry on the basis of transportation costs and on local prices and given boundary conditions for local supplies' markets.

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[1] Ibid., page 234.
[2] Ibid, page 244.

3.2.6. *The Perloff-Access Method*

A more relevant study for industry-selection could start from a chart as proposed by Harvey S. Perloff in his “How a region grows”[1]. We reproduce here his table.

TABLE 3.1. A SCHEMATIC PRESENTATION OF TYPES OF REGIONS THAT CAN EXHIBIT DIFFERENT GROWTH POTENTIALS

		GOOD ACCESS TO BASIC INPUTS[1] FROM EXTERNAL REGIONAL AND NATIONAL SOURCES		POOR ACCESS TO BASIC INPUTS[1] FROM EXTERNAL REGIONAL AND NATIONAL SOURCES	
		GOOD ACCESS TO BASIC INPUTS IN HOME REGION	POOR ACCESS TO BASIC INPUTS IN HOME REGION	GOOD ACCESS TO BASIC INPUTS IN HOME REGION	POOR ACCESS TO BASIC INPUTS IN HOME REGION
Poor access to external regional and national markets	Poor access to markets in home region......	1 II	2 I	3 I	4 0
	Good access to markets in home region......	5 III	6 II	7 II	8 I
Good access to external regional and national markets	Poor access to markets in home region	9 III	10 II	11 II	12 I
	Good access to markets in home region	13 IV	14 III	15 III	16 II

1. Not only basic resources but important intermediate sources need to be considered.

NOTE. Roman numerals indicate number of “good” access dimensions and suggest relative overall locational advantages or disadvantages.

Perloff explains his table in the following way:

“When regions are examined in terms of costs and markets, or *input-output* access, with regard to the requirements of specific industries and for all economic activities taken together, the extent to which they vary in their prospects for growth becomes apparent. The sixteen conceptual regions shown in Figure 3.1, oversimplified as they may be, serve to focus attention on the range of possible growth, and point up, for example, the fallacy of the extreme local economic-development approach which can lead to regard every region and community as capable of limitless economic expansion.

To the extent that a region's general access characteristics may be taken as a rough index of its potential for growth, Region 4 in Figure 3.1 would have little prospect for growth, while Region 13 would have an unsurpassed growth potential. Other regions fall in between these extremes. Regions 1, 2, 3, 8, 12, and 16 are only a little better off than 4. In these cases, reasonable access to inputs is offset by lack of market access—i.e., limited markets within easy reach—or vice versa. Thus, for example, one type of region may be developed to the extent that it contains an important mineral resource which is much in demand, but its development may be essentially limited to the exploitation of that particular mineral because of its disadvantage with regard to transporting almost all other products to distant markets. In general, regions 6, 7, 10, and 11 are somewhat better off since they at least have some access to both inputs and markets. Regions 5, 9, 14, and 15 are still better off because they have advantages either in large home markets or good access to national markets, combined with advantages in acquiring inputs or in shipping out their products or both.

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[1] Harvey S. Perloff with Vera W. Dodds, Committee for Economic Development, March 1963, page 31.

The restraint placed upon the future prospects for these regions also differs. Region 4 would have dim prospects of evolving into a region type with greater growth potential. Any change in its character must rest upon a doubly fortuitous set of circumstances. Technology, discovery, or institutional changes must bring about an improvement in its access to both inputs and markets. For region 3, which has good access to inputs in the home region but no external market, the prognosis is poor but not as hopeless. This region must either overcome the restriction upon its transfer relationships with other regions, or exploit its resources through a prolonged series of internal growth sequences. Region 12, with good access to external markets but poor access to input sources, might have a better prospect for breaking out of its dilemma. Discovery, technology or even the pressure of growing demand might improve its access to basic inputs.

In weighing the growth prospects of a region, its present production characteristics or state of development are of course significant, but they do not entirely determine the course of future growth. Consider the direction of growth sequences. Development is generally sought to follow a prescribed sequence, with growth initiated by advances in primary extractive activity, followed by the development of more and more advanced servicing activities. But when one considers the variety of growth experiences suggested in Figure 3.1, it is evident that this is not always the case for the regions of an economically advanced nation.

A region such as type 11 might show a sequence of development completely the reverse of the sequence typically hypothesized. Florida is an example. It has had a limited scope for development on the basis of the size of the home market and relatively poor access to external input sources. The major characteristic of its input access in the home region has been its coast and agreeable climate. Its access to external markets for this resource was good because, in our highly developed economy, population movements often take the form of a quest for amenities rather than economic opportunity. The exploitation of a resource was dominant in this development, but it is a special kind of resource that might be identified as a resource-service. No primary activities in the old sense of the word were associated with its exploitation. Rather, the exploitation of this resource required an intense development of tertiary activities which service population. In 1950, some 66 per cent of all employment in Florida was in the service activities. Market-oriented activities dominated.

With steadily mounting population—from 1,836,000 in 1939 to 4,442,000 in 1958—a stage is developing where the availability of business services in Florida is attracting increasing quantities of secondary manufacturing activities. Typical of these are small-scale, market-oriented manufacturing, such as metal construction products and relatively footloose activities such as electronics.

As the wealth and size of the population grows, deficit food supplies make possible the use of agricultural lands which at an earlier stage could not be considered a significant economic resource. This calls for an expansion in the primary sector of the economy. In this situation the tertiary-secondary-primary sequence is more logical than the reverse.

A growth sequence may possibly start in the "middle" and perhaps go both ways. A region of type 6 or 8 might exhibit this kind of sequence. Sometimes the exhaustion of a resource or the development of a substitute may leave a region "overdeveloped".

If labour is slow in moving out, the pool of relatively immobile labour with depressed wages may attract secondary manufacturing attracted to cheap labour—as has been happening in the Appalachian mining areas. The new secondary activity may induce growth sequences that lead to expansion in primary, tertiary and other secondary activities. If this should happen the region *may* regain a level of growth and production commensurate with that of other regions.

The variety of growth experience is apparent not only in the different sequences that are possible but also in the variety of functional pathways it might take. For a region (such as 7) with good access to inputs and markets only in the home region, growth is largely restricted to the internal evolution of specialization characteristic of more or less "closed" regions. In another region (such as 11) growth may take the form of inter-regional specialization in response to external specialization. In other regions (such as 13) it is more apt to be compounded of elements of both external and internal response. A region (such as 10) which has poor access to inputs and markets in the home region might sustain considerable growth because of its *nodal*, or strategic, position with reference to external resources and markets.

Regions vary widely in their capacity to achieve mature development. A rationalized, variegated, mature development of economic functions is unlikely in a region that does not have good access to large external national markets. All of the functions that are dominated by important external and internal scale economies would be denied to it. Such a region may have to continue its development through more limited specialized activities. Given sensible policies (and good luck) its people may enjoy high levels of living, but substantial growth in volume would be unlikely"[1].

It can be seen from this quotation (which, because of its importance, is given in extenso) that the above schematic presentation is a very useful device for evaluating the general situation of a region, especially in respect of its access to regional and national, markets and inputs. It may have even greater usefulness, if it is drawn up for each individual industry in a given region. The table would then contain information about the size of relevant local and regional inputs and markets, for the industry in question. A simplified schematic table for a given region and an industry with three factor inputs and two sales categories to two industries and final demand is given below: (*See table 3.2.*)

This type of table, together with Table 3.1 and estimated weights (attraction coefficients)[2] to be attached to the requirements and sales flows, can be used to evaluate the region's locational advantages or disadvantages and, therefore, which growth industries would be suitable and which unsuitable for the area.

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[1] Ibid., pages 30-34.

[2] To be discussed later (Chapter 7).

TABLE 3.2. SCHEMATIC PRESENTATION OF THE STRUCTURE OF A REGION RELEVANT TO INDUSTRY A

SUPPLY OF INPUTS FOR INDUSTRY A				DEMAND FOR OUTPUTS OF INDUSTRY A			
NO. OF INPUT	HOME REGION	STATE	GEOGRAPHIC DIVISION	NO. OF INDUSTRY	HOME REGION	STATE	GEOGRAPHIC DIVISION
	1	2	3		1	2	3
1	r_{11}	r_{12}	r_{13}	1	s_{11}	s_{12}	s_{13}
2	r_{21}	r_{22}	r_{23}	2	s_{21}	s_{22}	s_{23}
3	r_{31}	r_{32}	r_{33}	Final demand	f_1	f_2	f_3

As a first step, the data in Table 3.2 should be compared with the existing scope of the industry's activities in the three regions. The difference between the two pictures indicates existing inter-regional flows. If the situation is such that inputs must be imported, even into the wider geographic division and that products must be exported, the situation would not seem to be very favourable for the industry; with the opposite results, then a further, more detailed study seems justified. For each industry therefore, such a systematic analysis is required.

A numerical example of this type of analysis is given below. Let us assume that the structure of the region, relevant to industry A, is as presented in Table 3.3.

TABLE 3.3. REGIONAL STRUCTURE RELEVANT TO INDUSTRY A

SUPPLY OF INPUTS OF INDUSTRY A				DEMAND FOR OUTPUTS OF INDUSTRY A			
NO. OF INPUT	HOME REGION	STATE	GEOGRAPHIC DIVISION	NO. OF INDUSTRY	HOME REGION	STATE	GEOGRAPHIC DIVISION
1	50	500	2,000	1	100	1,000	2,000
2	30	130	500	2	400	550	600
3	120	400	4,000	Final demand	500	700	4,000

and that the structure of supplies from industry A and of its demand for inputs, is as given in Table 3.4.

TABLE 3.4. DEMAND FOR INPUTS AND SUPPLY OF OUTPUTS OF INDUSTRY A

DEMAND FOR INPUTS OF INDUSTRY A				SUPPLY OF OUTPUTS OF INDUSTRY A			
NO. OF INPUT	HOME REGION	STATE	GEOGRAPHIC DIVISION	NO. OF INDUSTRY	HOME REGION	STATE	GEOGRAPHIC DIVISION
1	40	200	1,500	1	50	500	1,500
2	20	100	600	2	200	300	700
3	110	500	5,000	Final demand	250	600	7,000

From these two tables, an import-export table for inputs and outputs can be derived:

TABLE 3.5. STRUCTURE OF INTER-REGIONAL TRADE IN INPUTS AND OUTPUTS OF INDUSTRY A

EXPORTS (+) AND IMPORTS (−) OF INPUTS				EXPORTS (+) AND IMPORTS (−) OF OUTPUTS			
NO. OF INPUT	HOME REGION	STATE	GEOGRAPHIC DIVISION	NO. OF INDUSTRY	HOME REGION	STATE	GEOGRAPHIC DIVISION
1	+10	+300	+ 500	1	− 50	−500	− 500
2	+10	+ 30	− 100	2	−200	−250	+ 100
3	+10	−100	−1,000	Final demand	−250	−100	+3,000

We can see from this table that: the home region is exporting inputs 1, 2 and 3, the state inputs 1 and 2 and the geographic division input 1; both the home region and the state are importing outputs 1 and 2 and final demand products and that the geographic division is importing output 1 and exporting output 2 and final demand products. It would seem that the industry would have good opportunities in the home region with relatively favourable conditions for exports to other part of the state, though fewer wider possibilities. Therefore, a medium sized industry in the home region would seem to have good development opportunities[1]. A further more detailed study of the industry, in which due attention is given to a demand forecast for the home region, the state and the geographic division and a forecast of input exports, would seem to be merited.

3.2.7. *The method of weighted inter-industry relations*

The above method is a major step towards a means of considering, simultaneously, both the structure of the area and that of a given industry. Such systematic studies for all industries would take us even nearer to an integrated selection method. There is one important problem still to be faced, however. Consider an area in which products for final demand need to be imported, some inputs imported and others exported. In this situation it is not immediately apparent whether or not it would be profitable for the industry concerned to locate in the area. This depends on the *weights* that are attached by the entrepreneur to the different input and output flows. A simple solution to this problem would be to use transportation costs per monetary unit of input or output as weights, in effect determining the optimum distribution of industries on the basis of the sum of production and transportation costs.

However, as explained earlier, the importance of distance cannot be expressed by transportation costs alone. Distance is a hindrance to frequent personal contacts, and makes partial use of such inferior substitutes as mail or telephone, unavoidable. The implications of contacts that are not ideal become more important the more complex the goods are that are being traded. Economic and social distance might be closely identified with physical distances if the product is homogeneous and simple in structure. Iron ore can be bought on sample and its delivery presents no major problems. Timber is somewhat different although still a relatively simple product. But machinery, semi-finished products and, even more, finished products require frequent contact between buyer and seller, if trade relations are not to give rise to difficulties. In fact, the economic and social distance, which in the present context is the only concept of distance that counts with any significance, might deviate considerably from physical distance, and if more complex less uniform products are involved, the latter is far from a good starting point for an analysis of the regional distribution of industry.

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[1] The type of analysis applied here is an extended version of the one used by J. Paelinck for the Liège region in Belgium.—J. Paelinck on a meeting of the Dutch and Flemish section of the Regional Science Association 1963.

If the product is homogeneous, simple in structure, and used in large quantities, then physical transportation costs do play a decisive role. For this reason, studies concerned with the optimum distribution of industry are automatically concerned with such industries—oil refineries, steel plants, paper and pulp factories are examples. Studies of this sort pay little or no attention to banking services, tool-making industries or perfume-factories. In fact, most activities do not fulfil the conditions necessary for such transport cost studies. Services are of ever increasing importance and industry is shifting more and more to the production of complex durables and light products. In all these activities transportation costs are of minor importance but there is a need for communications with related sectors linked if necessary for the proper functioning of the industrial process.

The only approach therefore, for a successful method of industry-selection is to determine the importance of communication between various industries and the influence this exerts on their spatial distribution. The weight to be attached to communications and their influence on the regional distribution of industry cannot be directly measured. The following method, described mathematically in Mathematical Appendix 2 and in more detail in the following chapters, is essentially an indirect one. A short description of the principles of the method are given first.

Only in special cases will the output of a given industry in a given region coincide with total regional demand (defined as final demand plus the demand of other industries) for the product; in most cases there will be a flow of either exports or imports. The same is true for the industry's requirements; supplies of these will either be imported from, or exported to, other regions, according to their level of production in the region and the local demand exerted for them of the industry in question. Only for large areas like the United States does demand for most products tend to equal supply, with imports and exports negligible.

The size of inter-regional trade is determined by the regional distribution of demand for, and production of the products of, the industry in question. Thus, the scale of activities of an industry in a given region will be determined both by the extent of the demand for its products in that region and the local supplies of its requirements. If the industry attaches equal monetary weights to demand in the region and to the different supply requirements in the region, we will call it *balanced.* Very few industries are exactly balanced in this sense. Many give priority to regional demand and not to the presence of industries supplying necessary requirements; others are more interested in supplies, and much less in the size of demand. Industries of the former type are demand-oriented, the latter supply-oriented. The regional scale of supply-oriented industries is sometimes determined by one supply requirement. For example, the regional size of many food processing industries depends almost completely on local supplies of agricultural products.

The strength of the attraction is evidently directly influenced by the level of communication costs (including transportation costs). In the case of many services, transportation is quite impossible, that is transportation costs are infinitely high. These services have to be produced locally and the industries are, thus, completely demand-oriented. In certain other branches, an increase in distance raises communication costs so sharply, that these too will tend to locate where the market and auxiliary services are concentrated.

It is essential, in the analysis, to take account of the fact that transportation cost proper is not the only factor, perhaps not even a major one, in the determination of the location of an industry—even when sufficient, qualified labour is not available in all possible locations. The importance of direct, quick, and often personal contact with related activities, business services, retailers, wholesalers and bankers may exert such a decisive influence that costs of physical transportation are, relatively, of negligible importance. In the analysis, therefore, we will consider the hypothetical *sum of transportation costs and communication costs* for markets and supplies, individually and try to discover how far these costs determine the location of the industries studied. The larger the costs of communication between two industries, the more they will be attracted to one other.

A close correspondence between the regional distribution of demand and production will be taken as an indication that the industry is demand-oriented, a close correspondence between the regional distribution of the supply of one or more of the industry's requirements and of its production, that the industry is supply-oriented. If no such correspondence, even for the largest regions, can be found, the industry will be regarded as footloose as far as communication costs (including transportation costs) are concerned. Clearly, the concept of a demand-oriented industry as defined above is closely related to that of the "non-basic" industries which, in fact, are usually completely demand-oriented. Moreover, both concepts apply to areas of a given minimum size—termed *relevant region*[1].

A consequence of these concepts is, of course, that the size of imports and exports of a region is very much dependent upon the degree of market-orientation which exists. If the industry is completely market-oriented, there will be no imports or exports of its output, since its production will be equal to demand in the relevant region. Thus, the relevant region in this case may also be defined as the areas enclosed by the boundaries over which no products are shipped.

3.3. LIMITATIONS OF THE METHODS PROPOSED; DYNAMICS IN LOCATION THEORY

To change the location of an industry is an extremely costly affair. The more capital-intensive the industry and the more it requires skilled workers, the larger the impact of a relocation and the more reluctant an entrepreneur will be to adjust himself to changing locational factors[2]. However, this does not apply

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[1] See also Chapter 7.

[2] Information about changes in location is given in D. Craemer, assisted by Richard Rothman, "*Changing Location of Manufacturing Employment*", Part I, Changes by Type of Location, 1947-1961. A research report from the Conference Board, New York 1964.

See also Harvey S. Perloff with Vera W. Dodds, "*How a region grows*", Area Development in the U.S. Economy. Supplementary Paper No. 17, Published by the Committee for Economic Development, New York 1963.

This paper is an abbreviated version of "*Regions, Resources and Economic Growth*", by Harvey S. Perloff, Edgar S. Dunn Jr., Eric E. Lampard, and Richard F. Muth, 1960.

Victor R. Fuchs, "*Changes in the Location of Manufacturing in the United States* with the same force to all industries. A rapidly growing industry must take new investment decisions continuously, each one permitting the advantages of the economies of scale within the enterprise to be weighed against those of a better location for the new unit. Therefore, it is likely that fast growing industries, on the whole, will be much "better" located in the sense that they have been able to adjust themselves to changing conditions to a greater extent than slow growing industries for which the adjustment might often be a too costly proposition. The growth rate of an industry is one of the main determinants of its physical mobility.

In drawing this conclusion we should realize that the growth rate of an industry is not constant over time. It slows down when it reaches maturity; the textile industry and the leather industry are perhaps the best examples of mature industries in the western world. Many food processing industries, certain sectors of the iron and steel industry and coal mining are examples of other industries that have already reached maturity or, at any rate, are close to it. The retardation in the growth of older industries, accompanied by impaired mobility, is one of the main reasons for the existence of industrially depressed areas in many parts of Europe and the United States.

The dynamic theory of location, that is a theory explaining the distribution of industries by location factors valid now as well as in the past, is not very well developed. Much more attention needs to be paid to the quantification of the influence of past location factors. This would help to emphasize that the present location factors will change and draw attention to the fact that long term forecasting in this field would contribute greatly to the achievement of more rational location decisions in the present. Such an approach seems to be preferable to one that simply takes it for granted that in addition to current factors, "historical factors" also help to explain the regional distribution of industries.

The age of an industry influences its degree of monopolization and through this its regional distribution and the degree to which it is "footloose". With a high degree of monopoly, the profit margin is usually high and consequently many factors are of less importance than they would be in other competitive situations. Industries making a new product, especially, tend to have a highly monopolized market. But since the growth rate of a new industry is usually high, the situation probably changes rapidly and, in order to be competitive, the sites of their new plants will be selected much more carefully than those of the original ones, and in the process, the distribution of the industry adjusted to the most important location factors.

All this suggests that some of the conclusions that can be drawn from the existing distribution of a given industry might be important only in the short, or medium-short, term. We should remember that the present distribution results from factors which operated in the past and which might change substantially in the future. It has already been stated that a major objection that can be levelled at the optimum regional distribution of an industry derived from the single criterion of transportation costs, is that other factors which played a role in the past are completely left out of consideration. Other methods

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since 1929", 1962.

An important contribution to the knowledge of regional growth patterns in employment has been made by the US Department of Commerce, Office of Business Economics in its publication "Growth Patterns in Employment by County 1940-1950 and 1950-1960". Washington 1965.

(including the one proposed by the present author) might tend to assume that current considerations influence present decisions more than in fact they do. It is certain, however, that the *present* situation has a notable influence on *current* locational decisions, whether or not the present situation results from decisions based on factors that have lost their importance.

"The importance of intermediate inputs, such as partially manufactured products, of market, and of scale economics suggests why the *existing* distribution of population and economic activities among and within the regions is itself a factor in the differing patterns of regional growth. The current agglomerations or concentrations, which are essentially the end-result of past growth, are themselves a significant influence of future growth. This is so because the overwhelming majority of locational decisions must take market, input, and transfer actions as *given*. Thus, the decision of the present, or the "marginal decision", is based to an important extent on the locational (and price) situation as it has evolved from the past. This is not to suggest that for the firm making a location or production decision is not the key consideration, but simply that at any point in time future costs and returns must necessarily be estimated in terms of the relatively slowly evolving national pattern of agglomeration"[1].

In using and judging the method that follows, these considerations should be kept in mind. As often and as far as possible the results obtained should be checked with any new information that becomes available as well as by the opinions of experts. A check, with new material was (partly) possible, in our examples, only in the case of the optical industry in larger regions. New census material might enable the results to be checked for the other industries also and *trends* in the coefficients estimated and used.

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[1] Harvey S. Perloff with Vera W. Dodds, op. cit., page 26.

Part II

DEMONSTRATION OF THE METHOD PROPOSED

2

Chapter 4

INTER-INDUSTRY RELATIONSHIPS OF THE ELECTRONIC COMPONENTS INDUSTRY

4.1. INTRODUCTION

In this chapter, the inter-industry relationships of the electronic components industry will be examined, in order to apply to it the proposed method. In Chapters 5 and 6 the same relationships will be examined, respectively, for the optical and glass industries. It will be shown how the results can be used to determine the locational requirements of the industries. The method is explained in greater detail in Chapter 7 and Mathematical Appendix 2.

The available information about the input-output relationships of the United States economy in 1958 is used to obtain a picture of the relationships of the electronic components industry with other industries and the demand sectors. Two categories of relationships, namely the distribution of gross output of the industry and the direct requirements of the industry, will be considered separately.

4.2. THE DISTRIBUTION OF THE ELECTRONIC INDUSTRY'S SALES

The following table shows how the sales of the electronic components industry are distributed between the various industries that buy more than 2 per cent of the industry's gross output, the final demand sectors and transfers to other industries.

If we exclude transfers to other industries from total gross output and correct for the net inventory change final demand accounts for 22 per cent and Industry No. 56, Radio, TV and Communication equipment for 43 per cent of the revised total. Thus, these two categories together account for about 65 per cent of total output.

In short, as far as *output* is concerned, the electronic components industry is strongly related to:

1. *The Radio, TV and Communication Equipment industry* (43 per cent);
2. *Final Demand* (22 per cent).

4.3. THE DISTRIBUTION OF THE ELECTRONIC INDUSTRY'S REQUIREMENTS

Value added in the electronic components industry amounts to about 50 per cent of total gross output; total requirements are, therefore, also about 50 per cent of total gross output. Industries delivering more than 2 per cent of total gross output to the industry are listed with their respective percentages in Table 4.2.

TABLE 4.1. DISTRIBUTION OF SALES OF ELECTRONIC COMPONENTS INDUSTRY TO INDUSTRIES BUYING MORE THAN 2 PER CENT OF THE TOTAL, TO FINAL DEMAND AND TRANSFERS TO INDUSTRIES

	PER CENT GROSS OUTPUT
I. *Sales to industries:*	
56 Radio, TV and Communication Equipment	39.0
71 Rental and Real Estate	8.8
57 Electronic components	6.1
53 Electric Industrial Equipments and Apparatus	3.9
62 Scientific and Controlling Instruments	3.6
51 Office, Computing and Accounting Machines	3.5
60 Aircrafts and Parts	2.8
All Other Industries	3.3
Total Sales to Industries	71.0
II. *Final demand:*	
Personal consumption expenditures	5.6
Gross private fixed capital formation	1.0
Net inventory change	−1.8
Gross exports	3.4
Federal Government purchases	8.8
State and Local Government purchases	*[1]
Total Final Demand	17.0
III. *Transfers to other Industries*	12.0
Total Gross Output	100.0

1. * stands here and later for less than 0.05 per cent.

TABLE 4.2. REQUIREMENTS OF ELECTRONIC COMPONENTS IN PERCENTAGE OF GROSS OUTPUT[1]

NO.	INDUSTRY	PERCENTAGE OF GROSS OUTPUT
57	Electronic components and accessories	6.1
38	Primary non-ferrous metal manufacturing	4.5
56	Radio, TV and Communication equipment	3.4
53	Electric Industrial Equipment and Apparatus	3.3
35	Glass and Glass products	3.2
41	Stampings, Screw Machine products and Bolts	2.3
37	Primary Iron and Steel Manufacturing	2.0
	Total	24.8
	All other industries	25.5
	Value added	49.7
		100.0

1. Only industries with more than 2 per cent are listed.

Thus, sales of these industries to the electronic components industry amount to about 49 per cent of total requirements; requirements supplied by other industries are distributed over 51 industries out of the possible 79.

4.4. GENERAL STRUCTURE OF REQUIREMENTS AND SALES OF THE ELECTRONIC INDUSTRY

This data provides us with certain *a priori* indications of the importance of locational requirements of the electronic components industry. The requirements and sales of the industry can be summarized thus:

TABLE 4.3. REQUIREMENTS AND SALES OF THE ELECTRONIC COMPONENTS INDUSTRY

IND. NO.	REQUIREMENTS		IND. NO.	SALES	
57	Electronic components + access.	6.1	57	Electronic components	6.1
38	Primary non-ferrous metal m.	4.5	71	Rental and real estate	8.8
56	Radio, TV and comm. Equipment	3.4	56	Radio	39.0
53	El. Ind. Equipment and Appar.	3.3	53	El. Ind. Equipment and Appar.	3.9
35	Glass and glass prod.	3.2	62	Scientific + contr. Instr.	3.6
41	Stamp. Screw, mach. pr. + bolts	2.3	51	Office, Comp. + acc. mach.	3.5
37	Primary Iron + steel man.	2.0	60	Aircrafts and parts	2.8
	Other industries	25.5		Other industries	3.3
	Value added	49.7		Final Demand	17.0
				Transfers to other industries	12.0
	Gross Output	100.0		Gross Output	100.0

And taking only the more important categories we simplify the picture even further.

TABLE 4.4. SIMPLIFIED PICTURE OF REQUIREMENTS AND SALES OF THE ELECTONIC COMPONENTS INDUSTRY

	REQUIREMENTS	SALES
1. Radio, TV and communication Equipment	3.4	39.0
2. Electronic components and accessories	6.1	6.1
3. Rental and real estate	—	8.8
4. All other industries	40.8[1]	17.1[2]
5. Value added	49.7	—
6. Final demand	—	17.0
7. Transfers to other industries	—	12.0
Total	100.0	100.0

1. 53 industries.
2. 18 industries.

This table includes "secondary" production. The distinction between primary production and secondary production is as follows. The primary output determines the industrial classification of the establishment, subsidiary output is called secondary. In the 1958 input-output table "secondary production of an industry is treated as if sold to the primary industry where it becomes part of the output available for distribution"[1]; this means, however, that the inputs of the industry with secondary production include inputs required to make its secondary as well as its primary output. This "transfer procedure" was used for the mining and manufacturing sectors. Redefinition of the outputs was considered essential when the inputs required for the secondary activity were markedly different from those required for the primary activity. For this reason we assume that the input-structure is the same for primary and secondary activities.

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[1] The 1958 Inter-industry Relations Study (Preliminary) United States Department of Commerce Office of Business Economics. National Economics Division, November 1964.

First, however, we eliminate deliveries within the industry group. This correction is made by considering only the requirements and sales to *other* industries other than the electronic components industry.

Table 4.4. then changes to the one below.

TABLE 4.5. REQUIREMENTS AND SALES OF THE ELECTRONIC COMPONENTS INDUSTRY

	REQUIREMENTS FROM OTHER INDUSTRIES	SALES TO OTHER INDUSTRIES
1. Radio, TV and Comm. Equipment	3.9	41.5
2. Rental and real estate	—	9.4
3. All other industries	46.4	18.2
4. Value added	49.7	—
5. Final demand	—	18.1
6. Transfers to other industries	—	12.8
Total	100.0	100.0

Now we can eliminate secondary production by assuming that the industry only makes primary products, changing the percentage sales to other industries accordingly. The results become:

TABLE 4.6. REQUIREMENTS FOR AND SALES OF PRIMARY PRODUCTS

	REQUIREMENTS FOR PRIMARY PRODUCTION FROM OTHER INDUSTRIES	SALES OF PRIMARY PRODUCTION TO OTHER INDUSTRIES
1. Radio, TV and Comm. Equipment	2.9	47.7
2. Rental and real estate	—	10.9
3. All other industries	44.8	21.0
4. Value added	53.3	—
5. Final Demand	—	20.4
Total	100.0	100.0

The importance of the various industries and of final demand can now be expressed as a percentage of the total of requirements for primary production and sales of primary products (excluding value added from the total):

TABLE 4.7. FINAL REPRESENTATION OF INTER-INDUSTRY RELATIONS OF THE ELECTRONIC COMPONENTS INDUSTRY

No.	INDUSTRY	REQUIREMENTS AND SALES IN % OF GROSS OUTPUT	REQUIREMENTS AND SALES IN % OF TOTAL REQUIREMENTS AND SALES
1.	Radio, TV and Comm. Equipment	51.6	34.6
2.	Rental and real estate	10.9	7.3
3.	All other industries	65.8	44.1
4.	Final Demand	20.4	13.8
	Total requirements and sales	148.7	100.0

Thus, preliminary conclusions are that, for the electronic components' industry:

1. The most important single industry-group is the Radio, TV and Communication Equipment Industry; its importance is 34.6 per cent of total requirements and sales of primary production to other industries.
2. Final demand absorbs 13.8 per cent of the total of requirements and sales as defined above.
3. All other industries (excluding agriculture and mining) have a weight of 44.1 per cent.
4. The Rental and Real Estate sector has a weight of 7.3, but since this sector is unimportant in our study, it is not considered further.

One point must be considered more closely. Whilst we have concluded that the Radio, TV and Communication Equipment industry is of great importance for the Industry of Electronic Components, the reverse might also be true and, therefore, the location of the Radio, TV and communication industry determine that of the electronic components industry, not the reverse. In fact, the input-output table shows that 18 per cent of the gross output of the Radio and TV industry is sold to the electronic components industry, while the percentage of the gross output of the latter industry sold to the Radio and TV industry was 39 per cent, or more than double. This suggests that the Radio and TV industry is much less dependent upon the electronic components industry than the latter on the former. Furthermore, since the Radio and TV industry sells as much as 65 per cent of its gross output to final demand, this industry is much more likely to be oriented towards final demand than towards the electronic components industry.

Therefore, our general conclusion is that, as far as the macro-locational requirements of the Electronic Components Industry are concerned:

1. total requirements and, to a certain extent, total sales, are spread over so many industries that location in an area with differentiated industry seems desirable;
2. the presence of the Radio, TV and Communication Equipment Industry seems to be particularly important;
3. and final demand is a third important factor to be taken into account.

Chapter 5

INTER-INDUSTRY RELATIONSHIPS OF THE OPTICAL, OPHTHALMIC AND PHOTOGRAPHIC EQUIPMENT INDUSTRY[1]

As with the electronic components industry also in this section we will consider both the distribution of gross output and the requirements of the optical industry.

5.1. THE DISTRIBUTION OF THE OPTICAL INDUSTRY'S SALES

In the following table, industries purchasing more than 2 per cent of the total gross output of the optical industry are listed.

TABLE 5.1. DISTRIBUTION OF SALES TO INDUSTRIES BUYING MORE THAN 2 PER CENT OF THE TOTAL, TO FINAL DEMAND AND TRANSFERS TO INDUSTRIES

	% GROSS OUTPUT
I. *Sales to industries:*	
26. Printing and Publishing	3.1
63. Optical industry	5.3
72. Hotels, Personal and Repair services excluding auto	6.5
73. Business services	11.9
77. Medical, educational services and non-profit organizations	4.5
All other industries	4.1
Total sales to industries	35.4
II. *Final Demand:*	
Personal Consumption Expenditures	28.9
Gross Private Fixed Capital Formation	10.1
Net Inventory Change	0.3
Gross Exports	5.6
Federal Government Purchases	8.4
State and Local Government Purchases	0.9
Total final demand	54.2
III. *Transfers to other industries*	10.4
Total Gross Output	100.0

It should be noted that of total gross output more than 54 per cent goes directly to final demand. Sales to industries amount to roughly 35 per cent of the total, of which about one third goes to Business Services. Together, Business Services, Hotels, etc., Medical etc. Organizations and final demand account for about 77 per cent of total output.

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[1] Henceforth, referred to as the Optical Industry.

5.2. THE DISTRIBUTION OF THE OPTICAL INDUSTRY'S REQUIREMENTS

Value added in the optical industry amounts to 52 per cent of gross output and, therefore, total requirements 48 per cent of gross output. The list of industries supplying requirements equivalent to more than 2 per cent of gross output is given in Table 5.2.

TABLE 5.2. REQUIREMENTS OF THE OPTICAL INDUSTRY IN PERCENTAGES OF GROSS OUTPUT[1]

NO.	INDUSTRY	PERCENTAGE OF GROSS OUTPUT
24	Paper and allied products, except containers	3.1
27	Chemicals and selected chemical products	5.9
38	Primary non-ferrous metal manufacturing	2.6
63	Optical, ophthalmic and photographic equipment	5.3
69	Wholesale and Retail trade	4.1
73	Business Services	5.5
80	Imports	3.8
	Total	30.3
	All other industries	17.7
	Value added	52.0
		100.0

[1] Only industries with more than 2 per cent are listed.

It appears that, in terms of supplies to the industry, about seven industries (including imports), providing together 30.3 per cent of gross output or 63 per cent of the total requirements of the optical industry, are important. The remaining 37 per cent of supplies derive from more than forty different industries.

5.3. GENERAL STRUCTURE OF REQUIREMENTS AND SALES OF THE OPTICAL INDUSTRY

The requirements and sales of the optical industry can be summarized thus: (*See table 5.3.*).

Removing deliveries within the industry—which amount only to 5.3 per cent of gross output—in the way described for the electronic components industry, we have: (*See table 5.4.*).

Expressing the results, per unit of requirements and sales of primary production to other industries, we have: (*See table 5.5.*).

Thus, it can be seen that final demand is very important for the optical industry with Business Services as the most important single industry and all other industries accounting for a further 16.3 per cent of the total. Together, these three categories are responsible for 74.4 per cent of total requirements and sales. The optical industry is very small in relation to the Business Services

TABLE 5.3. REQUIREMENTS AND SALES OF THE OPTICAL INDUSTRY

NO.	REQUIREMENTS + VALUE ADDED		NO.	SALES	
24	Paper and allied products	3.1	26	Printing and publishing	3.1
27	Chemicals etc.	5.9			
38	Primary non-ferrous metal	2.6			
63	Optical industry	5.3	63	Optical industry	5.3
69	Wholesale and retail	4.1	72	Hotels etc.	6.5
73	Business services	5.5	73	Business services	11.9
80	Imports	3.8	77	Medical etc. organizations	4.5
	All other industries	17.7		All other industries	4.1
	Total requirements	48.0		Final demand	54.2
	Value added	52.0		Transfers to other industries	10.4
				Total sales to industries	35.4
	Gross output	100.0		Gross output	100.0

TABLE 5.4. REQUIREMENTS AND SALES OF THE OPTICAL INDUSTRY

NO.	INDUSTRY	REQUIREMENTS FOR PRIMARY PRODUCTION, FROM OTHER INDUSTRIES	SALES OF PRIMARY PRODUCTION TO OTHER INDUSTRIES
24	Paper and allied products	3.3	—
27	Chemicals etc.	6.2	—
38	Primary non-ferrous metal	2.6	—
69	Wholesale and retail	4.3	—
73	Business services	5.8	14.1
80	Imports	4.1	—
	All other industries	18.8	4.9
26	Printing and publishing	—	3.7
72	Hotels etc	—	7.7
77	Medical etc. organizations	—	5.3
	Value added	54.9	—
	Final demand	—	64.3
	Total	100.0	100.0

TABLE 5.5. FINAL REPRESENTATION
OF INTER-INDUSTRY RELATIONSHIPS OF THE OPTICAL INDUSTRY

NO.	INDUSTRY	REQUIREMENTS AND SALES AS A % OF GROSS OUTPUT	REQUIREMENTS AND SALES AS A % OF TOTAL REQUIREMENTS AND SALES
	Final demand	64.3	44.4
73	Business Services	19.9	13.7
72	Hotels etc.	7.7	5.3
27	Chemicals etc.	6.2	4.3
77	Medical etc. organizations	5.3	3.6
69	Wholesale and retail	4.3	3.0
80	Imports	4.1	2.8
26	Printing and publishing	3.7	2.5
24	Paper and allied products	3.3	2.3
38	Primary non-ferrous metal	2.6	1.8
	All other industries	23.7	16.3
		145.1	100.9

industry, so that we can discount any reverse relationship. Furthermore, the other industries that are important to this industry, deliver the following percentages of the gross output to the final demand sector:

TABLE 5.6. THE IMPORTANCE OF FINAL DEMAND FOR FOUR RELEVANT INDUSTRIES

NO.	INDUSTRY	PERCENTAGE OF GROSS OUTPUT OF OPTICAL INDUSTRY	FINAL DEMAND IN PERCENTAGE OF GROSS OUTPUT OF RELEVANT INDUSTRY
72	Hotels etc.	7.8	80.4
27	Chemicals etc.	6.6	15.3
77	Medical etc. organizations	5.3	92.0
69	Wholesale and retail	4.6	71.0
	Weighted Average		63.5

Thus, these industries therefore despatch, on the average, 63.5 per cent of gross output to final demand.

Keeping in mind the fact that Business Services have connections with 79 of the possible 86 industries, our conclusions are:

1. The optical industry's main relationship is with the final demand sector.
2. The second most important link, the Business Services sector, itself depends a great deal on *all* other industries.
3. The industries next in importance to the optical industry, depend largely on final demand.

Chapter 6

INTER-INDUSTRY RELATIONSHIPS OF THE GLASS AND GLASS PRODUCTS INDUSTRY[1]

Again, the same method is used.

6.1. THE DISTRIBUTION OF THE GLASS INDUSTRY'S SALES

TABLE 6.1. DISTRIBUTION OF SALES TO INDUSTRIES BUYING MORE THAN 2 PER CENT OF THE TOTAL, TO FINAL DEMAND AND TRANSFERS TO INDUSTRIES

	% GROSS OUTPUT
I. *Sales to industries:*	
11. New Construction	3.9
12. Maintenance and repair construction	3.7
14. Food and kindred products	27.5
22. Household Furniture	2.1
23. Other furniture and fixtures	2.5
29. Drugs, cleaning and toilet preparations	6.0
35. Glass and Glass Products	4.8
55. Electric lighting and wiring equipment	3.0
57. Electronic components and accessories	3.8
59. Motor vehicles and equipment	10.6
69. Wholesale and retail trade	4.6
75. Automobile repair and services	4.4
All other industries	12.6
Total	89.5
II. *Final Demand:*	
Personal Consumption Expenditure	5.9
Gross Private Fixed Capital Formation	—
Net Inventory Change	−0.2
Gross Exports	3.1
Federal Government Purchases	0.1
State and Local Government Purchases	—
Total Final Demand	8.9
III. *Transfers to other industries*	1.6
Total Gross Output	100.0

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[1] Henceforth referred to as the Glass industry.

Table 6.1 lists the industries buying more than 2 per cent of total gross output and shows the percentages sold to final demand and transfers to other industries.

Clearly for the Glass industry final demand plays a very minor role, about 90 per cent of gross output being sold to other industries. It is a typical example of an industry producing an intermediate product. The Food industry is the most important market, taking about 30 per cent of total sales to industries. Next comes the motor vehicles and equipment industry which, together with automobile repair and services, absorbs about 17 per cent of total sales. Third is New Construction and Maintenance and Repair Construction with about 8.5 per cent. The three mentioned together, these three markets purchase about 55 per cent of total sales to industries.

6.2. THE DISTRIBUTION OF THE GLASS INDUSTRY'S REQUIREMENTS

Value added in the glass industry amounts to 55 per cent of gross output and requirements therefore to 45 per cent. The list of industries supplying requirements equivalent to more than 2 per cent of gross output is given in Table 6.2.

TABLE 6.2. REQUIREMENTS OF THE GLASS INDUSTRY IN PERCENTAGE OF GROSS OUTPUT[1]

NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT
25	Paperboard containers and boxes	7.6
27	Chemicals and selected chemical products	3.8
35	Glass and glass products	4.8
36	Stone and clay products	2.8
65	Transportation and warehousing	2.6
68	Electric, gas, water and sanitary services	3.6
69	Wholesale and retail trade	3.9
80	Imports	2.1
	All other industries (49)	13.3
	Total	44.5
	Value added	55.5
		100.0

[1] Only industries with more than 2 per cent are listed.

It should be mentioned that the glass industry's requirements from the electric, gas, water and sanitary services is one of the highest of all manufacturing industries; only the chemicals and fertilizers mineral mining industry and the electric, gas, water and sanitary services industry itself have relatively greater energy requirements. The glass industry's requirements are rather evenly spread over all the seven listed industries. The paperboard containers and boxes industry, which accounts for 7.6 per cent of gross output or 17 per cent of total requirements, is the most important.

6.3. GENERAL STRUCTURE OF REQUIREMENTS AND SALES OF THE GLASS INDUSTRY

The requirements and sales of the glass industry can be summarized thus (industry-groups 11 and 12 are combined as "construction", 22 and 23 as "furniture" and 55 and 57 as the "electric industry"):

TABLE 6.3. REQUIREMENTS AND SALES

NO.	IND. REQUIREMENTS		NO.	SALES	
25	Paperboard containers + boxes	7.6	11 and 12	Construction	7.6
35	Glass industry	4.8	35	Glass industry	4.8
69	Wholesale and retail trade	3.9	69	Wholesale and retail trade	4.6
27	Chemicals and chemical products	3.8	14	Food and kindred products	27.5
68	Electric, gas, water etc.	3.6	22 and 23	Furniture	4.6
36	Stone and Clay products	2.8	29	Drugs, cleaning etc.	6.0
65	Transportation and warehouse	2.6	55 and 57	Electric industry	6.8
80	Imports	2.1	59	Motor vehicles etc.	10.6
	All other industries	13.3	75	Automobile repair etc.	4.4
	Total requirements	44.5		All other industries	12.6
	Value added	55.5		Total sales to industries	89.5
				Final Demand	8.9
				Transfers to other industries	1.6
	Gross Output	100.0		Gross Output	100.0

Removing deliveries within the industry—which, again, and together with transfers to other industries are not very important—total requirements and sales may then be presented in the following manner:

TABLE 6.4. REQUIREMENTS AND SALES OF THE GLASS INDUSTRY

With the usual simplifying procedure, we obtain:

NO.	INDUSTRY	REQUIREMENTS AND SALES AS A % OF GROSS OUTPUT	REQUIREMENTS AND SALES AS A % OF TOTAL REQUIREMENTS AND SALES
14	Food and kindred	29.4	20.7
59	Motor vehicles etc.	11.3	8.0
11/12	Construction	8.1	5.6
25	Paperboard containers	7.7	5.4
29	Drugs, cleaning etc.	6.4	4.5
75	Automobile repair	4.8	3.4
69	Wholesale and retail trade	8.0	5.6
57	Electronic components	4.1	2.9
27	Chemicals etc.	4.0	2.8
68	Electric, gas, water	3.8	2.7
	All other industries	45.0	31.7
	Final Demand	9.4	6.7
	Total requirements and sales	142.0	100.0

The distribution of requirements and sales is so wide and concerns so many activities that it is very difficult to judge from these results, which hypothesis about locational requirements is the most realistic one for the glass industry. It would seem that:

1. the food industry is of considerable importance to the glass industry;
2. the motor vehicle industry and construction are of secondary importance;
3. a very large number of other industries are linked, in one way or another, with the glass industry;
4. energy supplies are relatively important to the glass industry.

Chapter 7

THE METHOD ADOPTED

7.1. General

A mathematical framework needs to be introduced at this stage in order to make the method, that will be applied to the data in the three preceding chapters, understandable. A detailed explanation of the method is given in the Mathematical Appendix and, therefore, we will limit ourselves, at this point, to an explanation of the final equation that will be tested for the three industries. The symbol φ_{kj} indicates the proportion of national production of industry k that is being produced in area j; and as a simplification, for purposes of exposition we will assume that industry k has two important requirements, of which the proportions produced in area j are φ_{1j} and φ_{2j} respectively. The relationship to be tested is:

$$\varphi_{kj} = \lambda_d \delta_{kj} + \lambda_1 \varphi_{1j} + \lambda_2 \varphi_{2j} \qquad (1)$$

where δ_{kj} is the proportion of total demand for k-products in area j.

The λ's in this equation represent the relative importance of transportation and/or communication costs either for the final product or the requirements. It is shown in the Mathematical Appendix that the sum of the λ's is always equal to unity. Thus if $\lambda_d = 1$, all other λ's are zero and the equation becomes

$$\varphi_{kj} = \delta_{kj}$$

In short, the proportion of total output of industry k stemming from area j equals the percentage of total demand for this output which is found in area j. That is, supply equals demand in each area and the industry is said to be completely market-oriented. If one of the other λ's equals unity the equation becomes

$$\varphi_{kj} = \varphi_{lj}$$

In this case, the proportion of output of industry k stemming from area j is completely determined by the supply position of certain requirements in area j. Between these two extreme solutions there can be many others, where different weights attach to total demand and the various requirements.

The retail trade is an example of the first category its size in a given area depending completely on the extent of the local demand for its products. At the other extreme is the industry processing agricultural products. In this industry output in a given area is completely determined by the local production of agricultural products. Other industries can be found between these limits.

It seems useful to reconcile these concepts with those of basic and non-basic industries. A plausible definition of a non-basic industry, in a given area, is that it is one which must sell its product within that area. It follows that a basic industry is one that is able to export its products. (It should be noted that a basic industry does not *necessarily* export; it is enough if it has the *ability* to export. Even where no exports actually result, the industry serves the purpose of replacing imports which, from the point of view of the area's balance of payments, is exactly the same). In short, a non-basic industry is a completely demand-oriented industry while a basic industry is supply-oriented. As we have seen, however, there are many possible intermediate positions and, accordingly, the basic—non-basic distinction, is an oversimplified one.

So far we have made no reference to the size of the areas involved in the analysis. In fact, as will be seen later, it is possible to vary the size of the area under consideration until the point is reached where a good correspondance obtains between the proportion of the industry located in the area and the explanatory variables; the chosen area is referred to as the relevant region. Clearly, the size of the region is also relevant to the concepts of basic and non-basic industries. The market covered by a green-grocer differs from that of a regional shopping centre or a brewery. In its simple form the basic—non-basic dichotomy fails to distinguish between these cases, although, in principle, account should be taken of them. For clarity, the distinction between basic- and non-basic should only be used if the size of the area involved is stipulated. What is basic and what is non-basic would then depend upon the size of the area under consideration. In short, the *relevant region* would become a very pertinent factor in deciding which industries are basic and which non-basic.

The concept of the relevant region is closely related to the hierarchy of commodities and regions introduced by W. Leontief and implemented by W. Isard[1]. Walter Isard writes in his Methods of Regional Analysis: an Introduction to Regional Science[2]:

> "A third design, one which rigorously speaking is not *inter-regional* but rather *intra-national* is the balanced regional model. The balanced regional model explicitly recognizes for a given nation an hierarchy of regions and commodities. Some commodities (e.g. motor vehicles) are able to stand transportation over great distances, because of a low weight-to-value ratio, because of economies of scale in production, because of large weight losses in the processing of certain localized raw materials, or because of a number of other factors. Others (e.g. cement) may have more restricted market areas—such as a large region, a cluster of states, or a metropolitan region and its hinterland. Still others (e.g. shoe repair service) may have severely restricted market areas, such as a community within a city or, at the extreme, a small neighbourhood or nucleus of dwelling units.
>
> Associated with this continuum of market areas is a continuum of commodities where each commodity is classified by the size of market within which it is sold, or by the size of the region within which the production and consumption of the commodity balance. National commodities are those commodities whose production and consumption balance only within the nation as a whole. Regional commodities of the first order are those whose production and consumption balance within the nation as well as within each first-order

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[1] Leontief, W. *et al.*, *Studies in the Structure of the American Economy*, Oxford University Press. New York 1953.

[2] W. Isard, *Methods of Regional Analysis: an Introduction to Regional Science*. Massachusetts-New York-London 1960, pages 345-346. See also, by the same author: *Location and Space Economy*, pages 57-60.

region. Regional commodities of the second order, whose markets are smaller than those of the first order are those whose production and consumption balance not only within the nation and each region of the first order but also within each region of the second order. Finally, local commodities (regional commodities of the n^{th} order) are those whose production and consumption balance not only within the nation, each region of the first order, each region of the second order, ..., and each region of the $(n-1)^{th}$ order, but also within each local area (region of the n^{th} order). In practice, however, only a limited number of commodity classes can be feasibly treated and hence only a highly restricted hierarchy of regions can be considered".

The size of the relevant region in this study is determined in the following way.

Equation (1) is tested statistically with data relating to the geographic divisions of the United States. By this means, estimates of the values of the λ coefficients and also the relevant correlation coefficients can be obtained. If one of the λ's proves to be close to unity, this indicates that the industry is either demand- or supply-oriented. The more an industry is supply-oriented the larger the relevant region within which production and consumption balance. Indeed when an industry is completely supply-oriented and, furthermore, the geographical distribution of supplies uncorrelated with the distribution of demand, then the relevant region is the nation. This is also the case for an industry that is footloose within the nation.

Where the industry is demand-oriented the correlation coefficient indicates what degree of correspondence obtains between production and consumption within the areas chosen. Thus, if λ_d is close to unity but the coefficient of correlation relatively low, we may conclude that the industry is demand-oriented but the size of the relevant region larger than the one chosen; a combination of areas into larger regions then will improve the result. If the correlation coefficient is satisfactorily high, the size of the relevant region has been found.

It follows that the procedure should be commenced on the basis of the smallest units for which statistical material is available. In the United States, these are not counties, nor even the States, but only wider Geographic Divisions. Fortunately, the market sizes of the chosen industries happen to be such that they exceed the Geographic Divisions and, therefore, the lack of data for smaller areas does not impair our analysis. However, this might not be the case for other industries.

The above framework and results of the following analysis allow us to reconsider the concept of a *footloose* industry. Firstly, we can see that, in the light of the foregoing considerations, it would not necessarily be the case that an industry becomes more footloose when transportation costs decrease in importance; this is only true for industries for which physical transportation is essential. It would certainly not hold for industries for which other types of communication are more important. These might be footloose, but not because transportation costs are low. Transportation costs for a number of industries and service activities never have been of great importance. More generally, it is always necessary to state *with respect to which factor* an industry is footloose. We will use the footloose concept with respect to inter-industry relations.

One further relevant conclusion that we will draw in the course of the study—this is that the glass industry and the electronic components industry have important relationships with certain other industries (for glass, these are foodprocessing, drugs and toilet preparations and motor vehicle production, and for the electronic components industry, the Radio and Television industry is a very important client) and if final demand is added to the demand exerted by those industries in *larger regions*, this total demand appears to be the main location consideration. It follows that, although both industries are "market-oriented", their location is not determined by the detailed distribution of demand but only broadly, between larger regions. That is, the industries are *footloose within the relevant regions*, the size of the latter depending upon the structure and characteristics of the industry.

This is an interesting conclusion, since, by introducing the concept of the relevant region, it enables the concept of footlooseness to be linked with that of Leontief's hierarchy of commodities. Using the concept in this sense an industry is completely footloose with regard to inter-industry relations only if the relevant region is the world; the activities of the United Nations are probably the only ones which could be so described. At the other extreme is the local shop for which the relevant region might be only one street or a few blocks. Yet this shop is in fact footloose within its relevant region, however small it may be. Thus, for each industry there is a relevant region which, for example, is quite large for the electronic components and the glass industries but even larger (in fact the whole of the United States) for the optical industry. It follows that an industry that is footloose in a small country may be found to be market-oriented in another, larger country.

In the case of the electronic components industry, for example, one concludes that its relevant region is so large that it can safely be assumed to be footloose in, for example, Great Britain, the size of which is smaller than the relevant region; this would apply *a fortiori* in countries as small as Holland, Belgium or Denmark. Luttrell states in his Factory Location and Industrial Movement[1] that two-thirds of British industry can be considered as footloose. It would seem, therefore, that this ratio or a higher one would be found in smaller countries, but considerably smaller ones in larger countries like the United States or Russia. Lutrell's statement means, essentially, that for two-thirds of British industry the size of the relevant region is greater than the size of the country. In a larger country, this would be true for fewer industries.

7.2. THE EQUATION FOR THE ELECTRONIC COMPONENTS INDUSTRY

7.2.1. *Requirements and sales*

The full list of sales and requirements of the electronic components industry are given in Tables B.1 and B.2 in Appendix B. From the industries listed in these tables are selected those that buy from or sell to the electronic components industry quantities valued at more than 4 per cent of the gross output of the electronic components industry. Five purchasing industries and one supplying industry are included in the final analysis. Among these industries, however, is the electronic components industry itself, selling to (requiring from) itself 6.1 per cent of total sales. These intra-industry deliveries mainly reflect lack of homogeneity of the industry-groups used and in Chapter 4 we corrected for them in a sense that only deliveries to and by the industry were considered, not those within the industry itself. The inter-industry relations of the industry that result after such a correction and also for transfers to other industries, are basically the same as the one already presented in Chapter 4, that is:

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[1] London 1962.

TABLE 7.1. TOTAL SALES AND REQUIREMENTS OF THE ELECTRONIC COMPONENTS INDUSTRY

REQUIREMENTS			SALES		
NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT EL. COMP. IND.	NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT EL. COMP. IND.
38	Primary non-ferr. met .	4.8	51	Office, comp. + acc.......	4.3
69	Wholesale and retail tr.	5.9	53	Electr. ind. eqpt..........	4.8
			56	Radio, TV and comm.....	47.7
			62	Scientific and contr.	4.4
			72	Hotels, personal rep.	10.7
	All other industries ...	28.2		All other industries.......	7.7
	Total requirements ...	46.7		Total sales to industries...	79.6
	Value added	53.3		Final demand	20.4
	Gross output	100.0		Gross output	100.0

The data presented in this table constitutes the basis of our analysis. Let us first consider total sales, that is the demand side. Here 5 industries together with final demand are the important sectors, together covering 92.3 per cent of total demand.

7.2.2. *Sales*

In order to estimate the demand for electronic components in a given region we have now to consider the output of the relevant industries and their consequent demand for such components.

TABLE 7.2. SALES OF THE ELECTRONIC COMPONENTS INDUSTRY AS PERCENTAGES OF GROSS OUTPUTS OF THE BUYING INDUSTRIES

NO.	INDUSTRY	SALES AS A PERCENTAGE OF THE GROSS OUTPUT OF BUYING INDUSTRIES
51	Office, computing and acc. machines.............................	4.1
53	Electr. Ind. Equipment	2.7
56	Radio, TV and Communication Equipment	18.0
62	Scientific and Contr. Instr.	2.8
72	Hotels, personal repair etc.	1.9

Thus, the demand exerted by other industries equals:

$$d_i = 0.041\,g_{51} + 0.027\,g_{53} + 0.180\,g_{56} + 0.028\,g_{62} + 0.019\,g_{72} \qquad (7.1)$$

where g_{51} represents the gross output of industry 51, etc.

To this, final demand must be added. The calculation of final demand is based on the composition of the 1958 GNP. The percentages of the different categories of final demand spent on products of the electronic components industry may be found in the input-output tables. The results are presented in Table 7.3.

TABLE 7.3. FINAL DEMAND FOR ELECTRONIC COMPONENTS

CATEGORY OF FINAL DEMAND	TOTAL OF CATEGORY *In billions of $*	PERCENTAGE SPENT ON IND. OF EL. COMP.	AMOUNT SPENT ON EL. COMP. *In billions of $*
Personal consumption expenditures	293.2	0.05	0.147
Gross private fixed capital formation	56.6	0.04	0.023
Gross exports	22.7	0.38	0.086
Federal government purchases	52.6	0.44	0.231
State and local government purchases	40.8	—	—
Total	464.9	—	0.487

Thus, the amount spent on electronic components amounted to 487 million dollars, that is 0.11 per cent of the GNP of 444.5 billion dollars in 1958. We will assume that this percentage holds for all regions. Writing g_0 for total gross product we have

$$d_f = 0.0011\, g_0 \tag{7.2}$$

and total demand for electronic components now may be estimated by region using equations (7.1) and (7.2). That is,

$$d_{57} = d_i + d_f \tag{7.3}$$

7.2.3. *Requirements*

Gross output in the electronic components industry equals 0.36 of that in the primary non-ferrous metal industry. Clearly, it could be the case that this requirements industry could become the limiting industry for the electronic components industry, in the sense that it would determine the size of the latter. We will use this hypothetical size of the electronic components industry for our analysis of the distribution of the industry over the regions of the United States. Thus, the second part of our equation (leaving wholesale and retail trade out of account) becomes

$$s = 0.36\lambda_{38}\, g_{38} \tag{7.4}$$

7.2.4. *The final hypothesis*

On the basis of equation (7.3)

$$d_{57} = d_i + d_f$$

we can now write the final relationship as

$$g_{57} = \lambda_d d_{57} + 0.36\lambda_{38}\, g_{38} \tag{7.5}$$

where g_{57} = output of industry 57 in a given region,

$$\lambda_d + \lambda_{38} = 1 \tag{7.6}$$

and the λ's represent the attraction coefficients. A high λ_d means that the distribution of gross output of industry 57 is greatly influenced by the distribution of regional demand; in this case, λ_{38} is of minor importance, the industry being market-oriented. If λ_{38} is high, the industry is supply-oriented, and the attraction of the market relatively weak.

7.3. THE EQUATION FOR THE OPTICAL INDUSTRY

7.3.1. *Requirements and sales*

The requirements and sales of the optical industry are given, on the same basis as those of the electronic components industry, in the table below, the data having been corrected for intra-industry deliveries and transfers to other industries as in Chapter 5. The basic material is presented in the Tables C.1 and C.2 of the Statistical Appendix C.

TABLE 7.4. TOTAL SALES AND REQUIREMENTS OF THE OPTICAL INDUSTRY

REQUIREMENTS			SALES		
NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT GLASS IND.	NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT GLASS IND.
27	Chemicals etc.	6.2	72	Hotels, personal serv.	7.7
69	Wholesale and retail	4.3	73	Business services	14.1
73	Business services	5.8	77	Medical, ed. serv.	5.3
80	Imports	4.1			
	Other industries	21.4		Other industries	4.9
	Total requirements	45.1		Total sales to ind.	35.7
	Value added	54.9		Final demand	64.3
	Gross output	100.0		Gross output	100.0

7.3.2. *Sales*

For the three most important purchasing industries, as for the industry of electronic components, we will express sales of the optical industry to these industries as percentages of their gross outputs.

TABLE 7.5. SALES OF THE OPTICAL INDUSTRY AS PERCENTAGES OF GROSS OUTPUTS OF THE BUYING INDUSTRIES

NO.	INDUSTRY	SALES AS A PERCENTAGE OF THE GROSS OUTPUT OF THE BUYING INDUSTRY
72	Hotels, Personal services etc.	8.7
73	Business Services	7.9
77	Medical, Ed. Services	3.2

Thus, the demand of the relevant industries may be written as

$$d_i = 0.087\,g_{72} + 0.079\,g_{73} + 0.032\,g_{77} \qquad (7.7)$$

Final demand for outputs of the optical industry is extremely important, absorbing about 64 per cent of the industry's total sales. The percentage of GNP spent on its products is derived in Table 7.6.

TABLE 7.6. FINAL DEMAND FOR OPTICAL PRODUCTS

CATEGORY OF FINAL DEMAND	TOTAL OF CATEGORY *In billions of $*	PERCENTAGE SPENT ON OPTICAL PRODUCTS	AMOUNT SPENT ON OPTICAL PRODUCTS *In billions of $*
Personal consumption expend	293.2	0.16	0.47
Gross private fixed capt. formation	56.6	0.26	0.15
Gross exports	22.7	0.38	0.09
Federal government purchases	52.6	0.25	0.13
State and local government purchases	40.8	0.04	0.02
Total	464.9	—	0.86

Thus, the proportion of GNP spent on optical products is 0.19 per cent and, again, we will assume that this percentage holds for all regions. We now may write for final demand for optical products as

$$d_f = 0.0019 g_0 \tag{7.8}$$

and total demand as

$$d_{63} = d_i + d_f \tag{7.9}$$

7.3.3. *Requirements*

The size of the optical industry compared with that of the chemicals industry is 0.18. Leaving wholesale and retail trade and business services out of consideration, the second part of our equation becomes

$$s = 0.18\lambda_{27} g_{27} \tag{7.10}$$

7.3.4. *The final hypothesis*

From the foregoing, we obtain

$$g_{63} = \lambda_d d_{63} + 0.18\lambda_{27} g_{27} \tag{7.11}$$

where g_{63} is gross output of industry 63 in a given region and, again,

$$\lambda_d + \lambda_{27} = 1 \tag{7.12}$$

7.4. THE EQUATION FOR THE GLASS INDUSTRY

7.4.1. *Requirements and sales*

The glass industry requires supplies from many industries and, in turn, itself provides products for many industries; only 9.4 per cent of its gross output is absorbed by final demand. The requirements and sales of this industry, from and to, other industries (above the 4 per cent level) are listed, as in Chapter 6, in Table 7.7. The basic data are presented in Table D.1 and D.2 of the Statistical Appendix D.

TABLE 7.7. TOTAL SALES AND REQUIREMENTS OF THE GLASS INDUSTRY

NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT GLASS IND.	NO.	INDUSTRY	PERCENTAGE GROSS OUTPUT GLASS IND.
25	Paperboard containers ..	7.7	11	New construction	4.2
27	Chemicals etc.	4.0	12	Maintenance and repair...	3.9
69	Wholesale and retail	4.1	14	Food and kindred pr......	29.4
			29	Drugs, cleaning etc.	6.4
			57	Electr. compon...........	4.1
			59	Motor vehicles + Eqt.....	11.3
			75	Automobile repair + S....	4.8
	All other industries	22.4		All other industries.......	26.5
	Total requirements....	42.0		Total sales	90.6
	Value added	58.0		Final demand	9.4
	Gross output	100.0		Gross output	100.0

7.4.2. *Sales*

As percentages of the gross outputs of the buying industries, they are:

TABLE 7.8. SALES OF THE GLASS INDUSTRY AS PERCENTAGES OF GROSS OUTPUTS OF THE BUYING INDUSTRIES

NO.	INDUSTRY	SALES AS A PERCENTAGE OF THE GROSS OUTPUT OF THE BUYING INDUSTRY
11	New Construction..	0.2
12	Maintenance and repair Constr..............................	0.5
14	Food and kindred products	0.9
29	Drugs, cleaning and toilet prep.............................	2.0
57	Electronic components....................................	3.2
59	Motor vehicles and Equipment	1.0
75	Automobile repair and services	1.2

From this table, we derive:

$$d_i = 0.002\,g_{11} + 0.005\,g_{12} + 0.009\,g_{14} + 0.020\,g_{29} + 0.032\,g_{57} + 0.010\,g_{59} + 0.012\,g_{75} \qquad (7.13)$$

And final demand is again derived in the following way:

TABLE 7.9. FINAL DEMAND FOR GLASS PRODUCTS

CATEGORY OF FINAL DEMAND	TOTAL OF CATEGORY *In billions of $*	PERCENTAGE SPENT ON GLASS PRODUCTS	AMOUNT SPENT ON GLASS PRODUCTS *In billions of $*
Personal consumption expenditures	293.2	0.04	0.12
Gross private fixed cap. formation	56.6	—	—
Gross exports..................................	22.7	0.29	0.07
Federal government purchases	52.6	—	—
State and local government purchases	40.8	—	—
Total	464.9	—	0.19

Thus, the proportion of GNP spent as final demand for glass products is 0.04 per cent, that is,

$$d_f = 0.0004 g_0 \tag{7.14}$$

and total demand

$$d_{35} = d_f + d_i \tag{7.15}$$

7.4.3. *Requirements*

The size of the glass industry compared with supplying industries (excluding the wholesale and retail trade and electricity, gas and water services) is given in Table 7.10.

TABLE 7.10. THE SIZE OF THE GLASS INDUSTRY COMPARED WITH RELEVANT INDUSTRIES

NO.	INDUSTRY	SIZE OF THE GLASS INDUSTRY AS A FRACTION OF THE RELEVANT INDUSTRY
25	Paperboard containers	0.77
27	Chemicals etc.	0.21

The second element of our final equation is therefore:

$$S = 0.77\lambda_{25} g_{25} + 0.21\lambda_{27} g_{27} \tag{7.16}$$

7.4.4. *The final hypothesis*

As the final equation we have

$$g_{35} = \lambda_d d_{35} + 0.77\lambda_{25} g_{25} + 0.21\lambda_{27} g_{27} \tag{7.17}$$

where g_{35} represents gross output of the glass industry in a given region and the remaining g's, the gross outputs of the relevant industries in that region. As before:

$$\lambda_d + \lambda_{25} + \lambda_{27} = 1 \tag{7.18}$$

the λ's again being the attraction coefficients.

7.5. A COMPUTATIONAL COMPLICATION

A minor complication arises from the fact that in the above paragraphs, certain industries, on both the sales and requirements sides, have been neglected. The reason why only a limited number of industries have been taken into account is obvious. An analysis of *all* relevant industries, however unimportant they may be, would be impossible; even a selection of the more important industries has produced a list of considerable length. Nevertheless, the fact that some industries have been left out of the picture may mean that a correction is required.

On the requirements-side, it is safe to assume that industries of very minor importance may be left out of account. Implicitly, this means that their attraction coefficients are assumed to be zero, that is they do not exert any influence on the location decision. On the demand side we will assume that the same attraction coefficient applies to each category of demand, and therefore that minor industries may not be left out of account. A correction needs to be made to our equations. In the case of the electronic components industry, 7.7 per cent of total demand was in fact neglected, in the optical industry 4.9 per cent and in the glass industry 26.5 per cent. The most reasonable assumption for the necessary correction would seem to be to assume that the percentage distribution of total demand is equal to that of our estimate of demand. This gives the following corrected equations.

$$g_{57} = 1.08\lambda_d d_{57} + 0.36\lambda_{38} g_{38} \tag{7.5'}$$

$$g_{63} = 1.05\lambda_d d_{63} + 0.18\lambda_{27} g_{27} \tag{7.11'}$$

$$g_{35} = 1.36\lambda_d d_{35} + 0.77\lambda_{25} g_{25} + 0.21\lambda_{27} g_{27} \tag{7.17'}$$

7.6. STATISTICAL COMPLICATIONS

More serious difficulties arise from imperfections in the available data. In particular, there are no regional breakdowns of GNP or of the gross outputs of the various industries. The regional data required in our analysis have to be derived from personal income and value added figures (and the latter is only available for manufacturing industries).

The ratio of GNP to personal income for the economy as a whole is used to derive regional estimates of GNP from regional personal income data.

Gross output for a given industry in a given region is obtained by assuming that it bears the same relation to value added (available for all regions) as it does on a national scale. This national relationship of gross output to value added can be obtained for each industry from the input-output table.

The greatest difficulties arise in the case of non-manufacturing industries and imports—that is all sectors with a code number over 65. For these industries no regional data are available and we therefore assume that the size of one of these sectors in any region, bears a fixed relationship to the total gross output of the region. This assumption has some justification, in that these non-manufacturing sectors—the wholesale and retail trade, and the electricity, gas, water, hotel, personal, medical, educational, and automobile repair services etc.—are typically non-basic ones. Only in the case of imports is this treatment not possible. Imports are therefore left out of account, though it should be remembered that they play a role in the optical industry. This procedure is justified for Business Services, since this sector has connections with all other industries and its size may therefore be represented by total gross output. The relationships are:

TABLE 7.11. PERCENTAGES OF GNP SPENT ON SELECTED NON-MANUFACTURING INDUSTRIES

NO.	INDUSTRY	PERCENTAGE OF GNP
68	Electric, gas, water	2.0
69	Wholesale and retail trade	15.1
72	Hotels etc.	2.2
73	Business services	0.7
75	Automobile repair	1.0
77	Medical services etc.	4.8

Thus, we assume that:

$$\left.\begin{aligned} g_{68} &= 0.020\,g_0 \\ g_{69} &= 0.151\,g_0 \\ g_{72} &= 0.022\,g_0 \\ g_{73} &= 0.007\,g_0 \\ g_{75} &= 0.010\,g_0 \\ g_{77} &= 0.048\,g_0 \end{aligned}\right\} \text{for } \textit{all} \text{ regions} \tag{7.19}$$

We can now rewrite the final equations as:

Industry Electronic Components:

$$g_{57} = 1.08\lambda_d d_{57} + 0.36\lambda_{38}\,g_{38}$$

where

$$d_{57} = 0.041\,g_{51} + 0.027\,g_{53} + 0.180\,g_{56} + 0.028\,g_{62} + 0.001514\,g_0. \tag{7.20}$$

Optical Industry:

$$g_{63} = 1.05\lambda_d d_{63} + 0.18\lambda_{27}\,g_{27}$$

where

$$d_{63} = 0.0079\,g_0 \tag{7.21}$$

Glass Industry:

$$g_{35} = 1.36\lambda_d d_{35} + 0.77\lambda_{25}\,g_{25} + 0.21\lambda_{27}\,g_{27}$$

where

$$d_{35} = 0.002\,g_{11} + 0.009\,g_{14} + 0.020\,g_{29} + 0.032\,g_{57} + 0.010\,g_{59} + 0.00052\,g_0 \tag{7.22}$$

For construction (industries 11 and 12), construction contract values by state are used (See Appendix F).

A final simplification is achieved by expressing demand and the size of the requirements industries in each region as a fraction of the national values. By this means, the numerical coefficients in the final equation are eliminated. The final equations become:

$$g'_{57} = \lambda_d d'_{57} + \lambda_{38} g'_{38} \tag{7.23}$$

$$g'_{63} = \lambda_d d'_{63} + \lambda_{27} g'_{27} \tag{7.24}$$

$$g'_{35} = \lambda_d d'_{35} + \lambda_{25} g'_{25} + \lambda_{27} g_{27} \tag{7.25}$$

where all g''s and d''s are expressed as percentages of the national gross output and total demand for the relevant industry.

Chapter 8

THE REGIONAL DISTRIBUTION OF THE ELECTRONIC COMPONENTS INDUSTRY

8.1. THE LOCATION OF THE INDUSTRY

The geographical distribution of the electronic components industry is shown in Table 8.1. The regions are shown on Map 1.

TABLE 8.1. THE GEOGRAPHICAL DISTRIBUTION OF THE ELECTRONIC COMPONENTS INDUSTRY

REGION	VALUE ADDED *In millions of $*	PERCENTAGES
New England	233	16.2
Middle Atlantic	557	38.8
East North Central	285	19.6
West North Central	46	3.2
South Atlantic	40	2.8
East South Central	47	3.3
West South Central	52	3.6
Mountain	8	0.6
Pacific	167	11.6
USA	1,435	100.0

A large part of the electronic components industry is located in the New England, Middle Atlantic and East North Central divisions. Together with the Pacific division this area (roughly coinciding with the Old Manufacturing Belt) contains 86.2 per cent of total industry. The rest of the divisions have fairly similar shares, except the Mountain division with only 0.6 per cent.

8.2. THE DISTRIBUTION OF DEMAND

On the basis of the value added data presented in Appendix H, and the distribution of total gross output per region (derived from the distribution of personal income), the regional distribution of demand for products of the electronic components industry may be calculated. This distribution which coincides largely with that of total value added by all manufacturing industries, is given in Table 8.2.

The regional distribution of demand for electronic components roughly coincides with that of production, except in the case of the East North Central division, which consumes considerably more of this industry's products than

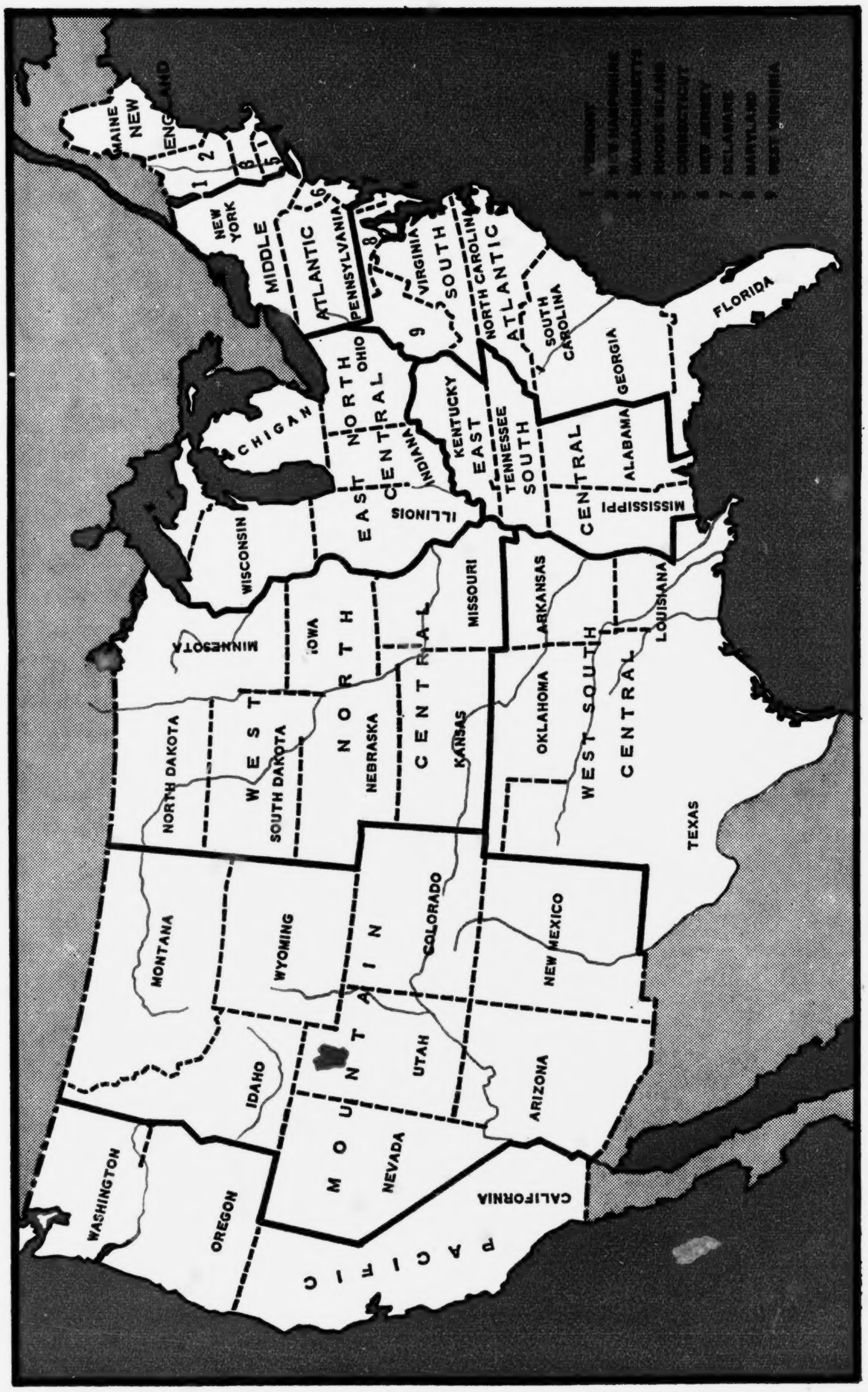
MAINE
NEW ENGLAND
1
2
3
4
5
6
7
8
9
NEW YORK
MIDDLE ATLANTIC
PENNSYLVANIA
VIRGINIA
SOUTH ATLANTIC
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
OHIO
CHIGAN
INDIANA
ILLINOIS
WISCONSIN
EAST NORTH CENTRAL
KENTUCKY
TENNESSEE
ALABAMA
MISSISSIPPI
EAST SOUTH CENTRAL
MINNESOTA
IOWA
MISSOURI
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
WEST NORTH CENTRAL
ARKANSAS
LOUISIANA
OKLAHOMA
TEXAS
WEST SOUTH CENTRAL
MONTANA
WYOMING
COLORADO
NEW MEXICO
IDAHO
UTAH
ARIZONA
NEVADA
MOUNTAIN
WASHINGTON
OREGON
CALIFORNIA
PACIFIC
1 VERMONT
2 NEW HAMPSHIRE
3 MASSACHUSETTS
4 RHODE ISLAND
5 CONNECTICUT
6 NEW JERSEY
7 DELAWARE
8 MARYLAND
9 WEST VIRGINIA

TABLE 8.2. THE DISTRIBUTION OF DEMAND FOR ELECTRONIC COMPONENTS

REGION	PERCENTAGE DISTRIBUTION OF TOTAL DEMAND FOR ELECTRONIC COMPONENTS
New England	8.8
Middle Atlantic	32.6
East North Central	32.0
West North Central	3.7
South Atlantic	7.1
East South Central	1.7
West South Central	3.4
Mountain	1.2
Pacific	9.5
USA	100.0

it produces. Intra-divisional imports and exports of the products of the industry are given in Table 8.3.

TABLE 8.3. INTER-REGIONAL TRADE IN THE PRODUCTS OF THE ELECTRONIC COMPONENTS INDUSTRY

NO.	REGION	PRODUCTION	DEMAND	NET IMPORTS	NET EXPORTS
		%			
1	New England	16.2	8.8		7.4
2	Middle Atlantic	38.8	32.6		6.2
3	East North Central	19.9	32.0	12.1	
4	West North Central	3.2	3.7	0.5	
5	South Atlantic	2.8	7.1	4.3	
6	East South Central	3.3	1.7		1.6
7	West South Central	3.6	3.4		0.2
8	Mountain	0.6	1.2	0.6	
9	Pacific	11.6	9.5		2.1
	USA	100.0	100.0	17.5	17.5

The East North Central is the largest importing, and New England and Middle Atlantic are the main exporting regions; there is a balance in the production and demand of the three regions when they are considered together. The figures suggest that there is a relation between the regional distribution of supply and demand for the products of this industry.

8.3. THE LOCATION OF SUPPLIES

For the electronic components industry's requirements we need to take into account only the non-ferrous metals industry. The percentage geographical distribution value added by this industry, is given in the following table.

By comparing the distribution of this industry with that of the electronic components industry we can derive the hypothetical, inter-divisional, imports and exports of the non-ferrous metal requirements.

TABLE 8.4. THE DISTRIBUTION OF THE NON-FERROUS METAL INDUSTRY

REGION	NON-FERROUS (38) PERCENTAGES
New England	9.5
Middle Atlantic	19.4
East North Central	27.8
West North Central	2.6
South Atlantic	4.3
East South Central	4.6
West South Central	6.9
Mountain	8.2
Pacific	16.7
USA	100.0
Percentage of gross output of the electronic components industry represented by these supplies	4.8

TABLE 8.5. NET IMPORTS AND EXPORTS OF REQUIREMENTS
NET IMPORTS (−) AND EXPORTS (+)

NO.	REGION	NON-FERROUS
1	New England	− 6.7
2	Middle Atlantic	−19.4
3	East North Central	+ 7.9
4	West North Central	− 0.6
5	South Atlantic	+ 1.5
6	East South Central	+ 1.3
7	West South Central	+ 3.3
8	Mountain	+ 7.6
9	Pacific	+ 5.1
	Total	26.7

It appears that the hypothetical inter-regional trade in these requirements is considerably larger than that in the products of the electronic components industry. This in itself suggests that the locational influence of the distribution of the non-ferrous metals industry is considerably less than that of electronic components' demand.

8.4. TESTING THE EQUATION

The statistical test of the equation (7.23) gives the following result:

$$g_{57} = 0.98\,d_{57} + 0.02\,g_{38} \qquad (r = 0.74)$$

This indicates that the electronic components industry is highly demand-oriented and that the influence of the non-ferrous metals industry is very minor. However, the correlation coefficient is relatively low, which means that the correspondence between the actual distribution of the electronic components industry and that predicted on the basis of the above equation and the distribution of demand for electronic components and the gross output of the non-ferrous metals industry is poor. This suggests that the equation should be tested for larger regions.

8.5. THE DISTRIBUTION OF THE DEMAND FOR AND REQUIREMENTS OF THE INDUSTRY BETWEEN LARGER REGIONS

The results of taking the regions New England, Middle Atlantic and East North Central together, as well as South Atlantic and East South Central, West North Central and West South Central[1] are shown in Table 8.6 for demand, and in Table 8.7 for the requirements from the non-ferrous metals industry.

TABLE 8.6. INTER-REGIONAL TRADE FOR LARGER REGIONS

REGION	PRODUCTION	DEMAND	NET-IMPORTS	NET-EXPORTS
I. New England Middle Atlantic East North Central	74.9	73.4		1.5
II. South Atlantic East South Central	6.1	8.8	2.7	
III. West North Central West South Central	6.8	7.1	0.3	
IV. Mountain	0.6	1.2	0.6	
V. Pacific	11.6	9.5		2.1
USA	100.0	100.0	3.6	3.6

It can be seen that there is a good correspondence between the production of and demand for electronic components in these regions.

TABLE 8.7. NET IMPORTS AND EXPORTS OF REQUIREMENTS FROM THE NON-FERROUS METALS INDUSTRY

REGION	NET IMPORTS (−) AND EXPORTS (+)
	NON-FERROUS
I. New England Middle Atlantic East North Central	−18.2
II. South Atlantic East South Central	+ 2.8
III. West North Central West South Central	+ 2.7
IV. Mountain	+ 7.6
V. Pacific	+ 5.1
Total	18.2

It is clear from this table that a good correspondence between the distribution of the electronic components industry and the non-ferrous metals industry could only be obtained by considering the United States as a single geographical unit.

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[1] For the criteria on the basis of which regions can be combined, see Mathematical Appendix 3.

8.6. TESTING THE EQUATION FOR THE LARGER REGIONS; CONCLUSIONS

Testing equation (7.23) for the larger regions yields the following regression equation:

$$g_{57} = 0.96\,d_{57} + 0.04\,g_{38} \qquad (r = 0.98)$$

It can be seen that now a very good correspondence is obtained. It may therefore be concluded that the electronic components industry is highly market-oriented for these relevant regions and that the location of non-ferrous metals industry has no real effect on the location of the electronic components industry. The relevant regions appear to be rather large and within them the electronic components industry may be considered footloose as far as industrial relationships are concerned.

Chapter 9

THE REGIONAL DISTRIBUTION OF THE OPTICAL INDUSTRY

9.1. The location of the industry

The distribution of value added in the optical industry between the geographical divisions of the United States is shown in Table 9.1.

Table 9.1. THE GEOGRAPHICAL DISTRIBUTION OF THE OPTICAL INDUSTRY

NO.	REGION	VALUE ADDED *In millions of $*	PER-CENTAGES
1	New England	120	12.3
2	Middle Atlantic	690	70.9
3	East North Central	109	11.2
4	West North Central	14	1.4
5	South Atlantic	10	1.0
6	East South Central	—	—
7	West South Central	3	0.3
8	Mountain	1	0.1
9	Pacific	27	2.8
	USA	974	100.0

The optical industry tends to be concentrated in the Middle Atlantic division. 94.4 per cent of the industry is located in the first three regions, roughly the Old Manufacturing Belt. The Pacific division has barely 2.8 per cent.

9.2. The distribution of demand

The regional distribution of demand for optical products is given in Table 9.2. These data were computed from those in Appendix H together with the coefficients calculated in Chapter 7. (*See table 9.2*).

Demand tends to be distributed between regions more or less in accordance with the distribution of GNP. The distribution of demand for optical products differs sharply from that of their production which is given in the following table. (*See table 9.3*).

It can be seen that inter-regional trade in optical products is very large, suggesting that the distribution of demand has little influence on the location of the optical products industry. The Middle Atlantic and New England are the only exporting regions, *all* others being importers. Even the Pacific division imports more than three times the value of its own production.

TABLE 9.2. THE DISTRIBUTION OF DEMAND FOR OPTICAL PRODUCTS

NO.	REGION	PERCENTAGE DISTRIBUTION OF TOTAL DEMAND FOR OPTICAL PRODUCTS
1	New England	6.5
2	Middle Atlantic	24.5
3	East North Central	22.4
4	West North Central	7.9
5	South Atlantic	11.3
6	East South Central	4.2
7	West South Central	7.3
8	Mountain	3.2
9	Pacific	12.7
	USA	100.0

TABLE 9.3. INTER-REGIONAL TRADE IN OPTICAL PRODUCTS

NO.	REGION	PRODUCTION	DEMAND	NET IMPORTS	NET EXPORTS
		%			
1	New England	12.3	6.5		5.8
2	Middle Atlantic	70.9	24.5		46.4
3	East North Central	11.2	22.4	11.2	
4	West North Central	1.4	7.9	6.5	
5	South Atlantic	1.0	11.3	10.3	
6	East South Central	—	4.2	4.2	
7	West South Central	0.3	7.3	7.0	
8	Mountain	0.1	3.2	3.1	
9	Pacific	2.8	12.7	9.9	
	USA	100.0	100.0	52.2	52.2

9.3. THE LOCATION OF SUPPLIES

Two industries are important to the optical products industry, the paper and chemicals industries. Their distribution over the nine regions is given in Table 9.4.

TABLE 9.4. THE DISTRIBUTION OF REQUIREMENTS OF THE OPTICAL PRODUCTS INDUSTRY

NO.	REGION	CHEMICALS (27) PERCENTAGES
1	New England	1.9
2	Middle Atlantic	18.8
3	East North Central	17.6
4	West North Central	5.3
5	South Atlantic	15.7
6	East South Central	9.3
7	West South Central	21.4
8	Mountain	2.2
9	Pacific	7.8
	USA	100.0

This industry shows a rather low concentration in the Old Manufacturing Belt, in contrast to the optical products industry. This contrast becomes clear when we calculate the hypothetical inter-regional trade in the requirements of the optical industry.

TABLE 9.5. NET IMPORTS AND EXPORTS OF REQUIREMENTS

NO.	REGION	NET IMPORTS (−) AND EXPORTS (+)
		CHEMICALS
1	New England	−10.4
2	Middle Atlantic	−52.1
3	East North Central	+ 6.4
4	West North Central	+ 3.9
5	South Atlantic	+14.7
6	East South Central	+ 9.3
7	West South Central	+21.1
8	Mountain	+ 2.1
9	Pacific	+ 5.0
	USA	62.5

We can see from these figures that inter-regional trade in the requirements of the optical industry is even larger than in the products of the industry. All regions except New England and Middle Atlantic are exporters.

9.4. TESTING THE EQUATION; CONCLUSIONS

In fact, the equation need not be tested statistically. For it is quite apparent that there is no correspondence whatsoever between the distribution of the optical products industry and demand for such products or the chemicals industry. The optical products industry appears to be completely footloose as far as industrial relationships are concerned, with the nation itself as the relevant region.

9.5. THE DISTRIBUTION OF THE EXPANSION OF THE OPTICAL INDUSTRY

How far does the distribution of increases in value added in the optical industry correspond to that of the total value added in the industry? We were unable to investigate this question in the case of the electronic components industry, since no comparable data were available for earlier periods. A reconstruction of the distribution of the optical industry in 1954 is possible on the basis of the United States Census of Manufacturers 1958, and can be compared with that in 1958. The results are given in Table 9.6; the figures of value added are not corrected for price changes.

We find that the distribution in 1954 corresponds closely with that in 1958 and that the increases of the period also show a similar distribution. There is a certain tendency towards New England, Pacific and South Atlantic. Of course, much of the expansion of an industry takes place in existing establishments so that there is naturally a certain tendency for growth to occur in the regions where the industry has been located. Nevertheless, it is remarkable that the concentration of the industry in the Middle Atlantic division remains so strong.

TABLE 9.6. VALUE ADDED IN THE OPTICAL INDUSTRY IN 1954 AND 1958

NO.	REGION	1958 VALUE ADDED		1954 VALUE ADDED		1954-1958 INCREASE	
		MIL-LION $	%	MIL-LION $	%	MIL-LION $	%
1	New England	120	12.3	80	10.0	40	23.1
2	Middle Atlantic	690	70.9	601	75.1	89	51.5
3	East North Central	109	11.2	92	11.5	17	9.8
4	West North Central	14	1.4	9	1.1	5	2.9
5	South Atlantic	10	1.0	—	—	10	5.8
6	East South Central	—	—	—	—	—	—
7	West South Central	3	0.3	—	—	3	1.7
8	Mountain	1	0.1	1	0.1	—	—
9	Pacific	27	2.8	18	2.2	9	5.2
	USA	974	100.0	801	100.0	173	100.0

9.6. CONCLUSIONS

Our conclusion is that, as far *as the inter-industry relationships are concerned* the optical industry is very footloose. The coefficients of attraction are therefore undetermined and communication costs appear to be negligible.

Chapter 10

THE REGIONAL DISTRIBUTION OF THE GLASS INDUSTRY

10.1. The location of the industry

The geographical distribution of value added in the glass industry is given in Table 10.1.

Table 10.1. THE GEOGRAPHICAL DISTRIBUTION OF THE GLASS INDUSTRY

No.	Region	Value added *In millions of $*	Percentages
1	New England	13	1.0
2	Middle Atlantic	391	28.9
3	East North Central	513	37.8
4	West North Central	28	2.1
5	South Atlantic	190	14.1
6	East South Central	60	4.4
7	West South Central	67	5.0
8	Mountain	—	—
9	Pacific	90	6.7
	USA	1,352	100.0

The industry tends to be concentrated in the East North Central and Middle Atlantic divisions and, to a lesser extent, in the South Atlantic division. Little of the industry is located in New England.

10.2. The distribution of demand

Demand for products of the glass industry stems largely from the food, drugs, toilet preparations and automobile industries. Its distribution between the geographic divisions is shown in Table 10.2.

Compared with the distribution of the gross output of the industry, the Middle Atlantic, East North Central and South Atlantic have a lower share of demand; New England and West North Central have a higher concentration of demand. Inter-regional trade is shown in Table 10.3.

The Middle Atlantic, East North Central and South Atlantic are the exporting regions and New England, West North Central and Pacific the main importing regions.

Table 10.2. THE DISTRIBUTION OF DEMAND FOR GLASS PRODUCTS

No.	Region	Percentage distribution of total demand for glass products
1	New England	4.9
2	Middle Atlantic	23.1
3	East North Central	30.7
4	West North Central	9.0
5	South Atlantic	9.0
6	East South Central	3.9
7	West South Central	5.7
8	Mountain	2.4
9	Pacific	11.3
	USA	100.0

Table 10.3. INTER-REGIONAL TRADE IN GLASS PRODUCTS

No.	Region	Production	Demand	Net imports	Net exports
		%			
1	New England	1.0	4.9	3.9	
2	Middle Atlantic	28.9	23.1		5.8
3	East North Central	37.8	30.7		7.1
4	West North Central	2.1	9.0	6.9	
5	South Atlantic	14.1	9.0		5.1
6	East South Central	4.4	3.9		0.5
7	West South Central	5.0	5.7	0.7	
8	Mountain	—	2.4	2.4	
9	Pacific	6.7	11.3	4.6	
	USA	100.0	100.0	18.5	18.5

10.3. The location of supplies

The distribution of supplies for the glass industry, from the Paperboard Containers and Boxes and the Chemicals industries, is presented in Table 10.4.

Table 10.4. DISTRIBUTION OF SUPPLIES FOR THE GLASS INDUSTRY

No.	Region	Paperboard containers + boxes industry	Chemicals industry
1	New England	8.5	1.9
2	Middle Atlantic	28.4	18.8
3	East North Central	28.0	17.6
4	West North Central	7.7	5.3
5	South Atlantic	10.9	15.7
6	East South Central	1.9	9.3
7	West South Central	4.0	21.4
8	Mountain	0.5	2.2
9	Pacific	10.1	7.8
	USA	100.0	100.0

Hypothetical inter-regional trade in requirements of the glass industry is shown in Table 10.5.

TABLE 10.5. INTER-REGIONAL TRADE IN REQUIREMENTS OF THE GLASS INDUSTRY

NO.	REGION	NET IMPORTS (−) AND EXPORTS (+)	
		PAPERBOARD CONTAINERS AND BOXES	CHEMICALS
1	New England	+ 7.5	+ 0.9
2	Middle Atlantic	− 0.5	−10.1
3	East North Central	− 9.8	−20.2
4	West North Central	+ 5.6	+ 3.2
5	South Atlantic	− 3.2	+ 1.6
6	East South Central	− 2.5	+ 4.9
7	West South Central	− 1.0	+16.4
8	Mountain	+ 0.5	+ 2.2
9	Pacific	+ 3.4	+ 1.1
	USA	17.0	30.3

The East North Central division is for both industries an importing region, while, except for the Middle Atlantic, all others are exporters.

10.4. TESTING THE EQUATION

Difficulties are raised when testing the equation because of the correspondance between the regional distribution of the paperboard containers and boxes industry and that of total demand for glass products. The equation is tested by omitting the data for the paperboard etc. industry; the consequences of this procedure are examined later (See section 10.6).

The results are:

$$g_{35} = 0.93\, d_{35} + 0.07\, g_{27} \qquad (r = 0.75)$$

It appears that the glass industry is very strongly demand-oriented. However, the correspondence between the actual and the theoretical distributions, as represented by the correlation coefficient is relatively poor, indicating that the chosen regions are relatively too small.

10.5. THE DISTRIBUTION OF THE DEMAND FOR, AND REQUIREMENTS OF, THE INDUSTRY BETWEEN LARGER REGIONS

If data for larger regions are used, the correspondence between the demand for and supply of glass products improves. (*See table 10.6*).

This table shows that demand and supply are reasonably well balanced if larger regions are considered. If inter-regional trade in requirements for the industry is also measured between these larger regions, we obtain: (*See table 10.7*).

The required inter-regional trade in the chemical requirements of the glass industry, still appears to be relatively high.

TABLE 10.6. INTER-REGIONAL TRADE IN GLASS PRODUCTS BETWEEN LARGER REGIONS

NO.	REGION	NET IMPORTS	NET EXPORTS
		%	
1+2	New England + Middle Atlantic		1.9
3+4	East North Central + West North Central		0.2
5	South Atlantic		5.1
6	East South Central		0.5
7	West South Central	0.7	
8	Mountain	2.4	
9	Pacific	4.6	
	Total	7.7	7.7

TABLE 10.7. INTER-REGIONAL TRADE IN REQUIREMENTS, BETWEEN LARGER REGIONS

NO.	REGION	NET IMPORTS (−) AND EXPORTS (+)	
		PAPERBOARD CONTAINERS AND BOXES	CHEMICALS
1+2	New England + Middle Atlantic	+ 7.0	− 9.2
3+4	East North Central + West North Central	− 3.2	−17.0
5	South Atlantic	− 3.2	+ 1.6
6	East South Central	− 2.5	+ 4.9
7	West South Central	− 1.0	+16.4
8	Mountain	+ 0.5	+ 2.2
9	Pacific	+ 3.4	+ 1.1
	Total	10.9	26.2

10.6. TESTING THE EQUATION FOR LARGER REGIONS; CONCLUSIONS

The result of the test for the larger regions—again excluding the paperboard industry—is:

$$g_{35} = 0.94\, d_{35} + 0.06\, g_{27} \qquad (r = 0.96)$$

That is, the glass industry appears to be very demand-oriented for larger relevant regions, the chemicals industry being of no real importance in its location. Within the (relatively large) relevant regions the glass industry is footloose.

The conclusion needs to be qualified by the fact that the paperboard and boxes industry was left out of account. In the author's view, the close correspondence between the paperboard and boxes industry and the glass industry is due to the fact that both tend to be demand-oriented within the same relevant regions. For this reason, the above conclusions need not be modified.

Chapter 11

PRELIMINARY CONCLUSIONS

We can see that the results of our analysis are completely different for the electronic components and glass industries, on the one hand, and for the optical industry on the other. The optical industry is, in fact, completely footloose as far as relationships with other industries and final demand are concerned, although the latter category absorbs a large proportion of the sales of this industry—more than 60 per cent. The industry is very heavily concentrated in the Old Manufacturing Belt, that is in the New England, Upper Middle Atlantic, Lower Middle Atlantic and Middle West divisions.

We also found that this conclusion is valid for the location of extensions to the optical industry. The optical industry is completely footloose within the nation being neither demand nor supply oriented. Factors other than inter-industry relationships have determined its location.

The electronic components industry appears to be highly market-oriented for larger regions. There are five such regions: the New Atlantic, Middle Atlantic and East North Central divisions comprise the first, South Atlantic and East South Central the second, the West North Central and West South Central the third and the Mountain and Pacific are the fourth and the fifth respectively. There is a good correspondence between production and consumption in these regions, indicating that the electronic components industry is market-oriented for relatively large regions within which it can be considered footloose as far as inter-industry relationships and final demand are concerned.

A similar conclusion applies to the glass industry. The average size of the relevant regions for this industry is somewhat smaller than in the case of electronic components. They are seven regions, the New England and Middle Atlantic divisions, the East North Central and West North Central, the South Atlantic, the East South Central, the West South Central, the Mountain and the Pacific. For these regions there is a very good correspondence between production and consumption, indicating that the glass industry is highly demand-oriented.

In the last chapter, we will examine in greater detail the consequences of the above conclusions for area development policy. First, however, some attention is paid to the influence of the labour factor on the location of the chosen industries.

Chapter 12

LABOUR ORIENTATION

12.1. Some Features of the Labour Forces

To a large extent, the nature of an industry is reflected in the composition of its value added and, more particularly, by the importance of wages and salaries in value added. In Chapter 3 we chose for examination in detail three labour-intensive growth industries—that is, three industries in which the payroll constitutes a high percentage of value added. This definition of a labour-intensive industry does not necessarily imply a high number of workers per unit of value added, since the payroll may also be important in industries where there are few but very expensive workers.

The number of workers employed in, and the payroll of, the three industries studied, are given in Table 12.1.

Table 12.1. EMPLOYMENT AND PAYROLLS IN THREE LABOUR-INTENSIVE INDUSTRIES IN 1960

INDUSTRY	ALL EMPLOYEES *Thousands*	PAYROLL *In million $*	PROD. WORKERS *Thousands*	MAN-HOURS OF WORKERS *Millions*	WAGES *Million $*
Electronic components	274	1,242	195	394	739
Optical industry	90	549	61	121	310
Glass industry	150	803	128	256	648

The electronic components industry is about three times as large as the optical industry and almost twice the size of the glass industry in terms of employment; in terms of wages it is only one and a half times as large as the glass industry and about 2.4 times the size of the optical industry. Clearly, the electronic components industry is qualitatively different from the other two. This becomes even more obvious if we calculate certain ratios from the data given in Table 12.1.

Thus: the electronic components industry pays relatively low wages both to production and non-production workers. ($3,690 and $6,400 respectively per annum, compared with $5,050 and $7,050 for the glass industry and $5,080 and $8,250 for the optical industry); the number of production workers as a percentage of total employees is about the same for the electronic components and optical industries, the glass industry having a far higher percentage. The electronic components industry employs relatively low-skilled production and non-production workers. The other two industries pay roughly the same wages to production workers, around 35 per cent more than the

TABLE 12.2. SOME FEATURES OF THE LABOUR FORCES

INDUSTRY	PAYROLL PER EMPLOYEE $	WAGE PER PRODUCTION WORKER $	PRODUCTION WORKER PER EMPLOYEE %	WAGE PER MAN-HOUR $	MAN-HOURS PER WORKER	SALARY PER NON-PROD. WORKER $
Electronic components...	4,540	3,690	70.3	1.87	2,000	6,400
Optical industry	6,100	5,080	68.0	2.57	1,980	8,250
Glass industry	5,070	5,050	85.5	2.52	2,000	7,050

electronic components industry. The optical industry pays its non-production workers 30 per cent more than the electronic components industry and the glass industry 10 per cent more. That is, the optical industry, requiring highly skilled workers, tends to pay the highest wages followed by the glass industry and then the electronic components industry. Labour intensity, measured by number of employees per million dollars value added, is largest in the electronic components industry (129), followed by the glass industry (91) and then the optical industry (75).

12.2. THE LABOUR-ORIENTATION OF THE INDUSTRIES

Although all three industries are labour-intensive, there are basic differences in the nature of their labour requirements. The optical industry needs very highly-skilled labour, the glass industry averagely skilled and the industry of electronic components low-skilled labour, and, accordingly, will have different location requirements. The lower the skill requirements, the more an industry takes account, merely, of the availability of labour; it is not quality but quantity that counts. The higher the skill requirements, the more the industry will be inclined to locate at the point where those special skills are available. In the former case, labour surplus areas will be attractive, in the latter, areas with the necessary skills, that is, in practice, the present location of the industry. We have seen that this is true of the optical industry.

A major impediment to the further examination of this aspect of the location problem is caused by the manner in which the data for manufacturing industries are presented in the Census of Manufactures. In principle, this Census contains data for all SMSA's with more than 40 thousand employees and for all counties. In practice, however, an analysis of three digit industries, and sometimes even of a two digit industry, is rendered impossible since the relevant data is not presented when there is a danger of individual firms being identified. It is unfortunate, however, that in these cases, no indication is even given of the existence of the industry or such a harmless statistic as its approximate size in terms of employment. The absence of such data makes it impossible to carry out a systematic detailed study of the location of three digit industries in counties and SMSA's.

The next most suitable analysis is to compare the distribution of two industries between larger SMSA's (that is, those with more than 40,000 employees) in those states for which more or less complete information is available. For the electronic components industry this information is available only for the states of California and Illinois. It appears that in the SMSA's[1] of the Los Angeles-Long Beach, San Francisco-Oakland and San Jose industrial locations, about 87 per cent of total state employment in manufacturing industries is found and 95 per cent of the state employment in the electronic components industry; the corresponding percentages for the Chicago and Illinois SMSA's are 81 per cent and 83 per cent respectively. This suggests that, relatively, the electronic components industry has no preference for larger cities or for industrial areas. In absolute terms, however, by far the larger part of this industry is located in urban areas.

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[1] SMSA = Standard Metropolitan Statistical Area

The only relevant information for the optical industry available is that employment in this industry in the state of Illinois is all found in the Chicago SMSA. Even this kind of information is not available for the glass industry.

This rather scanty information does, however, serve to confirm our hypothesis that the location of the electronic components industry is not influenced by special labour requirements. Its distribution within relevant areas corresponds roughly with the distribution of population. The heavy concentration of the optical industry, even within the geographic division, can be explained by the presence of very highly skilled workers in a limited areas. This very important locational requirement of the optical industry will determine, for a long time to come, its distribution within the United States, although there are some indications that, in the future, the latter will correspond rather more closely with actual demand than did its distribution in 1958.

Chapter 13

THE SIGNIFICANCE OF THE RESULTS FOR AREA INDUSTRIALIZATION POLICY

13.1. INTRODUCTION

We have now examined the problem of which factors are important in the distribution of three selected industries. The main conclusions are that all three are footloose within rather large relevant regions and that the distribution of final demand is the main factor in the case of the glass and electronic components industries. The results suggest that a suitable policy for attracting these industries to certain areas might be successful. Some examples are now given of larger areas that appear to fulfil the necessary conditions and within which the industries might be willing to locate. Although the following examples are based on geographic divisions, they also indicate the type of opportunities that may be open to smaller areas.

13.2. SOME PRACTICAL EXAMPLES

The first example concerns the South Atlantic division and the electronic components industry. Our main conclusion, for this industry, is that it is highly demand-oriented, having a coefficient of attraction for demand near to unity. The demand for electronic components in South Atlantic is 7.1 per cent of national production, the production of the region only 2.8 per cent—that is, this region imports roughly 60 per cent of its needs. Furthermore, we saw that, much less important, the location of the ferrous metals industry, a supplier of requirements to the electronic components industry is also relevant. Therefore, the fact that South Atlantic exports 35 per cent of its production of non-ferrous metal products, is also a favourable consideration. Similarly, the location of supplies of glass and industrial equipment, is of some very minor importance and, again, South Atlantic exports these items, 83 per cent and 50 per cent, respectively, of its production.

It would seem therefore that a feasibility study, to determine more precisely the conditions needed to attract this industry to areas within the South Atlantic region, would be justified.

A second example relates to the glass industry in the East North Central division. We found that demand was the main location factor for the glass industry, and of the various requirements only the paper board containers and boxes industry played a role, and then only a minor one. Output from the glass industry in East North Central amounts to 2.1 per cent of national production, while demand is 6.9 per cent of the national total; that is 70 per cent of the regions needs is imported. Furthermore, 73 per cent of the output of the paper board containers and boxes industry is exported. Thus a feasibility study again seems to be merited.

Thirdly, we found that the optical industry is completely footloose as far as the inter-industry relationships are concerned and therefore that its location is determined by factors other than these. For those regions where the inter-industry relationships are appropriate, it seems worthwhile to investigate these other locational requirements more thoroughly in order to determine how far they are provided by the area in question. The Pacific division is such a region. It has 12.7 per cent of the national demand for products of the optical industry. Yet it produces only 2.8 per cent of the total output, meaning that it imports about 79 per cent of its total requirements. As far as the necessary materials are concerned, the Pacific region exports 75 per cent of the output of its paper industry and 64 per cent of that of the chemicals industry. The region is also characterized by favourable inter-industry relationships. Further detailed study—for example, focussed on the possibilities of attracting skilled labour to the region—would therefore seem to be justified.

13.3. COMPLEMENTARY INDUSTRIAL COMPLEXES

These proposed further studies involve a twofold analysis: an examination of the structure of industry and a comparison of this structure with those of individual areas. If all industries are studied systematically in this way an industry can be chosen out of all the possibilities and action taken to attract it to the area in question. This requires that the central government and/or the area community must occupy themselves to a certain extent with location studies that otherwise would tend to be undertaken by industry itself. For two reasons, however, this procedure is desirable. Firstly, the local government has a responsibility to further, as much as possible the industrial development of the area, to create pleasant living conditions for the community and to attract to the area any activities that may contribute to its welfare. Any duplication of research by the local authorities and industry which this approach might involve would contribute to a more rational and correct choice for the location of the industry. Secondly, the local authorities evaluate the suitability of an industry for their territory from a wider point of view than industrial interests could possibly do; they consider the desirability of attracting *all* potential new industries, either individually or in combination. Industries will tend to judge the area solely from their own point of view and seldom consider location in an area in combination with other industries to which they are linked.

It is useful to explore further the possibility of inducing combinations of industries to settle in the area. Let us assume that the area has carried out the type of study indicated above and has decided upon one or more industries which are to be attracted to the area. It could then be assumed that the chosen industry responds and moves to the area, and the whole procedure could be repeated, taking into account the hypothetical effects of this location, in order to select a second industry that might profitably be located in the area. The presence of both industries would further improve local conditions and, in turn, a third study could be made, simulating their presence and effect. In this way some idea could be obtained of the possible future structure of the area, and appropriate action could be undertaken to attract to the area the prescribed complex of mutually linked industries. We will refer to such a complex as a *complementary industrial complex* since it is complementary to the existing industrial structure.

Certainly, the area should be prepared to provide, possibly in co-operation with other areas, all the facilities that the combination of industries would require in the area(s). As previously mentioned, a first requirement might be an industrial estate or zone[1] for the complementary complex (to which sections of the existing industry might also eventually move), conveniently located and providing all the necessary facilities. Such an estate might be administered by the local authorities, by the combination of industrial complex itself, by an independent entrepreneur or by a combination of these various interests in the framework of an estate management corporation.

"The development of a large industrial site requires a high degree of co-operation between the various authorities interested in the venture. Success will depend to a great extent on the way the activities of these authorities are co-ordinated by the estate management corporation. As this body is responsible for the layout and development of the site, it will have to conduct all negotiations with local, regional and other authorities and arrange with the public authorities for the supply of the essential services. It must also plan the distribution of services on the site and see that these are installed as and when required. To co-ordinate the work of consultants and contractors and organize the work on site, an adequate and competent staff organization should be set up"[2].

The legal form of such a corporation will, of course, depend very much upon the type of the area. Where the area is underdeveloped and just starting to (re-)industrialize, then the establishment of an industrial estate would probably require finance from one or more local authorities. Where the situation is different to this, private entrepreneurs might be sufficiently interested to participate. Usually however, such participation requires that industry is more developed than is normally the case in development areas.

13.4. THE PROVISION OF GENERAL AMENITIES

The success of a local industrialization policy by no means depends only on the outcome of studies of the type referred to in this report. The fulfilment of the necessary industry location conditions by no means assures that success will be achieved. Such success also requires that the local authorities succeed in making its area attractive in a much wider sense, for human beings as well as for industrial activities. An area development policy would remain sterile if it concentrated solely on attracting industries, no matter how well chosen the activities. The workers employed by these industries will need schools, restaurants, public utilities, parks, playgrounds, shopping facilities etc., and it should not be overlooked that in providing such facilities, any single area is competing with many others. And the more footloose an industry, —and, for example, our results indicate that the three chosen industries are footloose, as far as inter-industry relationships are concerned, within large relevant regions—the more the nature of the general facilities offered by the area will be important.

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[1] Full information about United States industrial estates is contained in Dr. L.S. BURNS' "*Planned Industrial Complexes in the U.S.*", Netherlands Economic Institute/ University of California, 1964. (To be published by the European Coal and Steel Community in 1966). See also: United Nations "*The Physical Planning of Industrial Estates*", New York 1962, "*Industrial Estates in Asia and the Far East*", New York 1962, and "*Establishments in Industrial Estates in Under-Developed Countries*", New York 1961.

[2] G.G. LANHAM, "*Problems in establishment of large-scale industrial estates, in Industrial Estates in Asia and the Far East*". New York 1962, page 397.

It is extremely useful, therefore, for an area to review and compare its own general amenities with those of other, comparable, areas in order to find out in where it leads and in what respect it is deficient. Such a study should not be restricted to the available physical facilities, but should also cover the area's human resources—the capabilities of the local officials, of the available engineering staff and the quality of the local labour force, for example. It should also be understood that a growing population and welfare improvements not only raise the demand for existing facilities but also create a need for entirely new ones. Better schools and facilities for higher education will have to be provided, in order to meet the need for more sophisticated management both in industry and government.

Only where the local authorities are aware of these requirements does a local industrialization policy have a chance of success. This goal will only be attained as a result of local action founded upon practical and thorough research in all the relevant fields.

"All the help in the world will not redevelop an area which does not take the initiative itself. Local leadership, local government, local resources, local business, local labour—these are the only bases on which a sound redevelopment programme can be built"[1].

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[1] *The community and economic development*, U.S. Department of Commerce, Area Redevelopment Administration, Washington May 1964, page 35.

APPENDICES

Mathematical Appendix 1

THE COBB-DOUGLAS FUNCTION AND THE SHARE OF LABOUR

1.1. The extended Cobb-Douglas production function is given by

$$P = \alpha_0 L^{\alpha_1} C^{\alpha_2} e^{rt} \tag{1.1}$$

in which P represents net production (value added),
L = number of workers employed,
C = quantity of capital employed,
r = autonomous rate of increase in net production.

$$\alpha_1 + \alpha_2 = 1.$$

1.2. If the wage rate w is given, the entrepreneur will employ so much labour that in the equilibrium situation marginal productivity of labour equals the wage rate. This means:

$$\frac{\partial P}{\partial L} = w = \alpha_0 \alpha_1 L^{\alpha_1 - 1} C^{\alpha_2} e^{rt} = \alpha_1 \frac{P}{L} \tag{1.2}$$

1.3. From this, it follows that the total wage-bill is a constant fraction α of net value added since

$$\frac{wL}{P} = \alpha_1 \tag{1.3}$$

Mathematical Appendix 2

ANALYSIS OF INTER-INDUSTRY RELATIONSHIPS IN LOCATION THEORY

2.1. Let s_{kl} be the sales of industry k to industry l ($k = 1, 2, \ldots, n$), and r_{kl} the requirements of industry k from industry l ($l = 1, 2, \ldots, n$). Then

$$s_{kl} = r_{lk} \tag{2.1}$$

2.2. The sales of industry k to industry l expressed in gross output of industry k equal

$$s_{kl} = \alpha_{kl} g_k \tag{2.2}$$

The sales of industry k to industry l expressed in gross output of industry l equal

$$r_{lk} = s_{kl} = \beta_{lk} g_l \tag{2.3}$$

2.3. The sales of industry l to industry k equal

$$r_{kl} = s_{lk} = \alpha_{lk} g_l \tag{2.4}$$

2.4. We call r_{kl} the requirements of industry k and s_{kl} the sales of industry k respectively from industry l and to industry l.

2.5. Total sales of industry k are

$$s_k = \sum_l \alpha_{kl} g_k = \sum_l \beta_{lk} g_l \tag{2.5}$$

Total requirements of industry k equal

$$r_k = \sum_l \alpha_{lk} g_l \tag{2.6}$$

2.6. By definition

$$g_k = s_k + f_k \tag{2.7}$$

where g_k = gross output of industry k,
f_k = final demand for products of industry k, and

$$g_k = r_k + v_k \tag{2.8}$$

where v_k = value added in industry k.

2.7. Up to now, exports and imports have been neglected. They are assumed to be negligible for the nation but, of course, must be taken into account for a given region. Write d_{kj} for the total demand for products of industry k in region j ($j = 1, 2, \ldots, m$).

Then

$$d_{kj} = f_{kj}+s_{kj} \tag{2.9}$$

and

$$x_{kj} = g_{kj}-d_{kj} \tag{2.10}$$

where x_{kj} represents exports of the products of industry k from region j.

2.8. We now write

$$\begin{aligned} g_{kj} &= d_{kj}+x_{kj} \\ &= \alpha_{kf}f_j + \sum_l \beta_{lk}\, g_{lj}+x_{kj} \end{aligned} \tag{2.11}$$

where f_j is total final demand, and $\alpha_{kf} f_j$ the final demand for products of industry k in region j. That is, α_{kf} is the proportion of total final demand f_j in region j spent on products of industry k.

2.9. For the sales of industry l to industry k we may write

$$s_{lkj} = \alpha_{lk}\, g_{lj} \tag{2.12}$$

The total requirements of industry k of products of industry l are given by

$$r_{klj} = \beta_{kl}\, g_{kj} \tag{2.13}$$

Net imports of requirements l in region j for industry k are thus equal to

$$m_{klj} = \beta_{kl}\, g_{kj}-\alpha_{lk}\, g_{lj} \tag{2.14}$$

Thus total imports for industry k equal

$$m_{kj} = \beta_k\, g_{kj} - \sum_l \alpha_{lk}\, g_{lj} \tag{2.15}$$

where β_k is total requirements as a proportion of gross output of industry k.
Thus,

$$\beta_k = 1-\alpha_{vk} \tag{2.16}$$

where α_{vk} is the proportion of value added in the gross output of industry k.

2.10. From (2.15) follows that

$$g_{kj} = \frac{1}{\beta_k}\sum_l \alpha_{lk}\, g_{lj} + \frac{1}{\beta_k}\, m_{kj} \tag{2.16}$$

2.11. Now k may be either a product-exporting or a requirements-importing industry or both. Assuming the costs of transporting the product plus the costs of communication for the sale of the product within the region to be zero (symbolic expression for relatively low) and for exports t_d, then total costs of communication and for transportation of the product equal

$$t_d x_{kj}$$

where

$$x_{kj} = g_{kj}-d_{kj} \tag{2.17}$$

Writing t_l for transportation and communication costs of one unit of requirement l brought from outside the region, then total transportation costs equal

$$t_{kj} = t_x(g_{kj}-d_{kj}) + \sum t_l(\beta_{kl}g_{kj}-\alpha_{lk}g_{lj}) \qquad (l \neq t) \tag{2.18}$$

g_{lj} refers to gross output of all sectors, l, *excluding* transportation and communication (t). (2.18) may be rewritten as

$$t_{kj} = (t_d + \sum t_l\beta_{kl})g_{kj} - t_d d_{kj} - \sum t_l\alpha_{lk}g_{lj} \qquad (l \neq t) \tag{2.19}$$

or

$$g_{kj} = \frac{t_d}{t_d + \sum t_l\beta_{kl}} d_{kj} + \sum \frac{t_l\beta_{kl}}{t_d + \sum t_l\beta_{kl}} \cdot \frac{\alpha_{lk}}{\beta_{kl}} g_{lj} + \frac{\beta_{kt}}{t_d + \sum t_l\beta_{kl}} \cdot \frac{\alpha_{tk}}{\beta_{kt}} g_{tj} \; (l \neq t) \tag{2.20}$$

where β_{kt} represents the requirements of the industry k from the transportation and communication sectors and α_{tk} the fraction of the output of the transportation and communication sectors sold to industry k.

Now put

$$\frac{t_d}{t_d + \sum t_l\beta_{kl}} = \lambda_d \tag{2.21}$$

and

$$\frac{t_l\beta_{kl}}{t_d + \sum t_l\beta_{kl}} = \lambda_l \tag{2.22}$$

then (2.20) becomes

$$g_{kj} = \lambda_d d_{kj} + \sum \lambda_l \frac{\alpha_{lk}}{\beta_{kl}} g_{lj} \;\; (1 = 1, 2, \ldots t, \ldots, n) \tag{2.23}$$

where

$$\lambda_d + \sum \lambda_l = 1 \tag{2.24}$$

and g_{kj} covers gross output of all sectors *including* transportation and communication.

(1) If all $\lambda_l = 0$, $\lambda_d = 1$. Then

$$g_{kj} = d_{kj} \tag{2.25}$$

The size of industry k in region j thus equals demand in region j, and demand in region j determines the size of industry k in region j. In this case the industry is referred to as *completely market-oriented* or demand-oriented. Imports and/or exports of requirements are exogenously determined, imports or exports of the products of industry k are zero.

(2) With one $\lambda_l = 1$, all other λ_l's together with λ_d are zero. Then,

$$g_{kj} = \frac{\alpha_{lk}}{\beta_{kl}} g_{lj} \tag{2.26}$$

In this case, the size of industry k is completely determined by the supply of industry l; industry k is said to be completely *supply-l-oriented.* If industry l in the region has reached its maximum size it is termed a *bottleneck-industry.* Imports and/or exports of k-products and the other requirements are exogenously determined and α_{lk}/β_{kl} gives the ratio of the size of industry k to industry l in the nation.

(3) We call the industry *balanced* if $t_d = t_l$. In that case

$$\lambda_d = \frac{1}{1+\beta_k} \quad \text{and each} \quad \lambda_l = \frac{\beta_{kl}}{1+\beta_k} \tag{2.27}$$

(4) The industry is *said to be footloose* within the relevant region if all t's are zero. The λ's then become undetermined. The size of the industry in a region may be smaller than or equal to the size of the industry in the nation, independent of d_{kj} and g_{lj}. A general *coefficient of orientation* may be constructed as follows. The deviations from the balanced values are

$$\lambda_d - \frac{1}{1+\beta_k} \quad \text{and} \quad \lambda_l - \frac{\beta_{kl}}{1+\beta_k} \quad \text{respectively.} \tag{2.28}$$

These deviations may be positive or negative. The sum of the absolute values of the deviations equals

$$\mathrm{S} = \left|\lambda_d - \frac{1}{1+\beta_k}\right| + \sum\left|\lambda_l - \frac{\beta_{kl}}{1+\beta_k}\right| \tag{2.29}$$

This sum is a maximum if for the smallest β_{kl} the value for λ is l. Since the smallest β_{kl} equals zero, the maximum deviation equals

$$\mathrm{S}_{\max} = 2$$

We now may write

$$\omega = \frac{\left|\lambda_d - \frac{1}{1+\beta_k}\right| + \sum\left|\lambda_l - \frac{\beta_{kl}}{1+\beta_k}\right|}{2} \tag{2.30}$$

$$0 \leqslant \omega < 1$$

For $\omega = 0$, the industry is neutral.
For $\omega = 1$ the relatively most unimportant requirement determines the size of the industry. The industry is completely l-oriented.

2.12. (1) It may be remarked here that the coefficients of attraction are closely related to the degree to which an industry is basic or non-basic. If non-basic industries are defined as industries which are not able to export or import economically their goods or services, this definition coincides with the case where $\lambda_d = 1$. Basic industries then may be defined as all industries for which $\lambda_d < 1/1+\beta_k$. The difference between the two concepts is of course that the coefficients of attraction may take any value between 0 and 1, while the concepts of basic and non-basic industries only allow for two possibilities.

(2) For all industries with relatively very high transportation or communication costs for the products, λ_d will be very high. If requirement l is extremely voluminous and/or heavy, λ_l will be very high. $\lambda_l = 1$ means infinitely high transportation costs and/or communication costs between the industry's location and the place where l is supplied. $\lambda_d = 1$ means that transportation and/or communication costs of the product are infinitely high; as far as final products are concerned, this is the mathematical expression for non-transportable goods (services).

2.13. Equation (2.18) may be tested even when data about the number of workers per region, and not gross output per region, are available.

Let us write

$$g_{kj} = \gamma_k \cdot w_{kj}$$

where γ_{kj} = gross output per worker in industry k, and
w_{kj} = number of workers in industry k in region j.
We may then rewrite equation (2.18) as

$$\gamma_k \cdot w_{kj} = \lambda_d \gamma_{oj} \cdot w_{oj} + \sum \frac{\alpha_{lk}}{\beta_{kl}} \cdot \lambda_l \gamma_l w_{lj} \tag{2.32}$$

(where γ_0 stands for gross output per worker in region j and w_{0j} for total number of workers in region j).
(2.20) may be written as

$$w_{kj} = \lambda_d \frac{\gamma_{oj}}{\gamma_k} w_{oj} + \sum \lambda_l \frac{\alpha_{lk}}{\beta_{kl}} \cdot \frac{\gamma_l}{\gamma_k} w_{lj} \tag{2.33}$$

In this equation,

(1) γ_{0j} will need to be estimated on the basis of the ratio of personal per capita income (or other income measure per capita) to GNP for the economy as a whole. Personal income data are usually available.

(2) w_{0j} is defined as the total number of workers, in all industries and agriculture.

2.14. Let us write

$$g_{kj} = \lambda_d d_{kj} + \sum \lambda_l \frac{\alpha_{lk}}{\beta_{kl}} g_{lj} \tag{2.34}$$

Expressing all variables as proportions of their corresponding values in the economy as a whole, we obtain

$$\frac{g_{kj}}{g_k} g_k = \lambda_d \frac{d_{kj}}{d_k} d_k + \sum \lambda_l \frac{\alpha_{lk}}{\beta_{kl}} \cdot \frac{g_{lj}}{g_l} \cdot g_l \tag{2.35}$$

and since $g_k = d_k = (\alpha_{lk}/\beta_{kl}) g_l$ we may write (2.35) as

$$\frac{g_{kj}}{g_k} = \lambda_d \frac{d_{kj}}{d_k} + \sum \lambda_l \frac{g_{lj}}{g_l} \tag{2.36}$$

2.15. This relationship can be rewritten as:

$$\varphi_{kj} = \lambda_d \delta_{kj} + \sum \lambda_l \varphi_{lj} \tag{2.37}$$

where

$$\varphi_{kj} = \frac{g_{kj}}{g_k}, \; \delta_{kj} = \frac{d_{kj}}{d_k} \quad \text{and} \quad \varphi_{lj} = \frac{g_{lj}}{g_l}$$

and $j = 1, 2, ..., m$. Equation (2.37) may be tested by regression-analysis. The value of the correlation coefficient of (2.37) is an increasing function of the size of the regions, or, given the size of the economy, a decreasing function of m. The size of the region for which the correlation coefficient reaches an acceptable value is called the relevant size of the region or simply, *the relevant region.* Within the relevant regions the industry is footloose as far as inter-industry relations are concerned.

Results for both the electronic components and the glass-industries yield λ_d's that are close to unity; the relevant regions are combinations of geographic divisions. For the optical industry the relevant region for demand and supplies appears to be the economy; this industry is completely footloose as far as inter-industry relations are concerned.

Mathematical Appendix 3

THE DETERMINATION OF RELEVANT REGIONS

There are m regions. Write x_j for net exports of one region j. Then

$$\sum x_j = 0 \tag{3.1}$$

Total volume of exports is given by

$$X = \frac{\sum |x_j|}{2} \tag{3.2}$$

X is a non-increasing function of m.

The relevant regions are found as the set of combinations of areas that produces an acceptable value (> 0.90), for the coefficient of correlation. For the various combinations of regions, two constraints are valid: the areas taken together should have a common border; a combination of areas should show a smaller volume of net exports than the areas that have been combined together. Combinations within both these constraints, are consistent and efficient.

STATISTICAL APPENDICES

Appendix A

LIST OF INDUSTRIES

1958 INPUT-OUTPUT NO.	INDUSTRY	RELATED SIC CODES (1957 edition)
1	Livestock and Livestock Products	013, pt 014, 0193, pt 02, pt 0729
2	Other Agricultural Products	011, 012, pt 014, 0192, 0199, pt 02
3	Forestry and Fishery Products	074, 081, 082, 084, 086, 091
4	Agricultural, Forestry and Fishery Services	071, 0723, 0729, pt 085, 098
5	Iron and Ferro-alloy Ores Mining	1011, 106
6	Non-ferrous Metal Ores Mining	102, 103, 104, 105, 108, 109
7	Coal mining	11, 12
8	Crude Petroleum and Natural Gas	1311, 1321
9	Stone and Clay Mining + Quarrying	141, 142, 144, 145, 148, 149
10	Chemicals + Fertilizers Mineral Mining	147
11	New Construction	138, pt 15, pt 16, pt 17, pt 6561
12	Maintenance, Repair Construction	pt 15, pt 16, pt 17
13	Ordnance and Accessories	19
14	Food and Kindred Products	20
15	Tobacco Manufactures	21
16	Broad and Narrow Fabrics, Yarn and Thread Mills	221, 222, 223, 224, 226, 228
17	Misc. Textile Goods and Floor Coverings	227, 229
18	Apparel	225, 23 (excl. 239), 3992
19	Misc. Fabricated Textile Products	239
20	Lumber and Wood Products, except Containers	24 (excl. 244)
21	Wooden Containers	244
22	Household Furniture	251
23	Other Furniture and Fixtures	25 (excl. 251)
24	Paper and Allied Products, except Containers	26 (excl. 265)
25	Paperboard Containers and boxes	265
26	Printing and Publishing	27
27	Chemicals and Selected Chemical Products	281 (excl. alumina pt of 2819), 286, 287, 289
28	Plastics and Synthetic Materials	282
29	Drugs, Cleaning and Toilet Prep	283, 284
30	Paints and Allied Products	285
31	Petroleum Refining + Related Products	29
32	Rubber and Misc. Plastics P.	30
33	Leather Tanning + Industrial Leather Products	311, 312
34	Footwear and other Leather Products	31 (excl. 311, 312)
35	Glass and Glass Products	321, 322, 323
36	Stone and Clay Products	324, 325, 326, 327, 328, 329
37	Primary Iron and Steel Manufacture	331, 332, 3391, 3399

1958 INPUT-OUTPUT NO.	INDUSTRY	RELATED SIC CODES (1957 edition)
38	Primary Non-ferrous Metal Manufactures......	2819 (alumina only), 333, 334, 335, 336, 3392
39	Metal Containers	3411, 3491
40	Heating, Plumbing and Structural Metal Products	343, 344
41	Stampings, Screw Machine Prod. + Bolts	345, 346
42	Other Fabricated Metal Prod.	342, 347, 348, 349 (excl. 3491)
43	Engines and Turbines........................	351
44	Farm Machinery and Equipment	352
45	Construction, Mining and Oil Field Machinery .	3531, 3532, 3533
46	Materials Handling Machinery + Equipment ...	3534, 3535, 3536, 3537
47	Metal working Machinery and Equipment......	354
48	Special Industry Machinery + Equipment......	355
49	General Industrial Machinery + Equipment	356
50	Machine Shop Products........	359
51	Office, Computing and Accounting Machines ...	357
52	Service Industry Machines	358
53	Electric Industrial Equipment and Apparatus ...	361, 362
54	Household Appliances......................	363
55	Electric Lighting and Wiring Equipment	364
56	Radio, Television and Communication Equipment	365, 366
57	Electronic Components and Accessories........	367
58	Misc. Electrical Machinery, Equipment and Supplies	369
59	Motor Vehicles and Equip....................	371
60	Aircraft and Parts..........................	372
61	Other Transportation Equip.	373, 374, 375, 379
62	Scientific + Controlling Instruments...........	381, 382, 384, 387
63	Optical,Ophthalmic and Photographic Equipment	383, 385, 386
64	Miscellaneous Manufactures..................	39 (excl. 3992)
65	Transportation and Warehouses	40, 41, 42, 44, 45, 46, 47
66	Communications, excl. Radio and TV Broadcasting..................................	481, 482, 489
67	Radio and TV Broadcasting	483
68	Electric, Gas, Water + Sanitary Services	49
69	Wholesale and Retail Trade	50 (excl. man. sales offices) 52, 53, 54, 55, 56, 57, 58, 59, pt 7399
70	Finance and Insurance.......................	60, 61, 62, 63, 64, 66, 67
71	Real Estate and Rental	65 (excl. 6541 and pt 6561)
72	Hotels, Personal and Repair Services excl. Auto.	70, 72, 76 (excl. 7694 and 7699)
73	Business Services...........................	6541, 73 (excl. 7361, 7391 and pt 7399) 81, 89 (excl. 8921) 7694, 7699
74	Research and Development..................	—
75	Automobile and Repair Service	75
76	Amusements	78, 79
77	Medical, Educational Serv. and Non-Profit Organisations	0722, 7361, 80, 82, 84, 86, 8921
78	Federal Government Enterp.	—
79	State and Local Govern. Enterp..............	—
80A	Directly Allocated Imports	—
80B	Transferred Imports	—
81	Business Travel, Entertainm. and Gifts	—
82	Office Supplies.............................	—
83	Scrap, Used and Second-hand Goods..........	—
84	Government Industry.......................	—
85	Rest of the World Industry..................	—
86	Household Industry	—

Appendix B

THE ELECTRONIC COMPONENTS AND ACCESSORIES INDUSTRY

TABLE B.1. TOTAL SALES OF THE ELECTRONIC COMPONENTS INDUSTRY

REQUIREMENTS OF INDUSTRY l FROM THE ELECTRONIC COMP. INDUSTRY AS A FRACTION OF GROSS OUTPUT OF IND. l (β_{lk})	NUMBER OF THE INDUSTRY (l)	SALES OF THE ELEC. COMP. INDUSTRY TO IND. l, AS A % OF GROSS OUTPUT OF THE ELECT. COMP. INDUSTRY (α_{kl})	REQUIREMENTS OF INDUSTRY l FROM ELECTRONIC COMP. INDUSTRY AS A FRACTION OF GROSS OUTPUT OF IND. l (β_{lk})	NUMBER OF THE INDUSTRY (l)	SALES OF THE ELECTRONIC COMPONENTS INDUSTRY TO IND. l, AS % OF GROSS OUTPUT OF THE ELECT. COMP. INDUSTRY (α_{kl})
0.00105	8	(0.4)	0.04092	51	(3.5)
0.00004	11	(0.1)	0.00006	52	*
0.00001	12	*	0.02722	53	(3.9)
0.00071	13	(0.1)	0.00002	54	—
0.00001	19	—	0.00348	55	—
0.00030	22	—	0.17986	56	(39 0)
0.00010	23	—	0.06101	57	(6.1)
0.00006	26	—	0.01328	58	(0.4)
0.00029	32	—	0.00077	59	(0.6)
0.00061	34	—	0.00599	60	(2.8)
0.00024	36	—	0.00009	61	*
0.00020	38	—	0.02812	62	(3.6)
0.00099	40	—	0.00013	63	—
0.00092	41	*	0.00192	64	(0.3)
0.00077	42	(0.1)	0.00073	65	(0.9)
0.00016	45	—	0.00057	66	(0.2)
0.00043	46	—	0.00010	69	—
0.00009	47	—	0.00022	71	—
0.00256	48	—	0.01913	72	(8.8)
0.00030	49	*	0.02641	74	—
0.00008	50	—			

* Not mentioned.

TABLE B.2. TOTAL REQUIREMENTS OF THE ELECTRONIC COMPONENTS INDUSTRY

REQUIREMENTS AS A PERCENTAGE OF THE GROSS OUTPUT OF INDUSTRY *l*	NUMBER OF THE INDUSTRY (*l*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE ELECTR. COMP. INDUSTRY	REQUIREMENTS AS A PERCENTAGE OF THE GROSS OUTPUT OF INDUSTRY *l*	NUMBER OF THE INDUSTRY (*l*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE ELECTR. COMP. INDUSTRY
*	7	(0.00016)	0.2	53	(0.03317)
*	12	(0.00075)	0.5	55	(0.00797)
*	18	(0.00133)	*	56	(0.03387)
*	20	(0.00026)	6.1	57	(0.06101)
0.4	22	(0.00538)	0.1	62	(0.00473)
0.1	24	(0.01178)	*	63	(0.00032)
0.4	25	(0.00555)	*	64	(0.00157)
*	26	(0.00055)	0.1	65	(0.01071)
0.3	27	(0.01145)	0.1	66	(0.00283)
0.5	28	(0.00765)	0.1	68	(0.00742)
*	29	(0.00006)	0.2	69	(0.05470)
0.1	30	(0.00063)	*	70	(0.00479)
*	31	(0.00159)	0.1	71	(0.02012)
0.3	32	(0.00664)	*	72	(0.00192)
*	33	(0.00005)	0.1	73	(0.01013)
*	34	(0.00002)	*	74	(0.00075)
3.8	35	(0.03181)	*	75	(0.00002)
0.2	36	(0.00694)	*	76	(0.00004)
0.3	37	(0.02027)	*	77	(0.00103)
1.2	38	(0.04481)	0.2	78	(0.00329)
*	40	(0.00045)	*	79	(0.00018)
1.7	41	(0.02329)	0.1	80A	(0.00272)
0.5	42	(0.01348)	*	80B	
0.4	47	(0.00574)	0.8	81	(0.02021)
*	49	(0.00100)	0.2	82	(0.00119)
0.2	50	(0.00103)			

Industries not included:

13 (0.0830) 45 → (0.00075) 51 (0.00472) 54 (0.00075)
23 (0.00002) 48 → (0.00038) 52 (0.00001) 58 (0.00075)

Appendix C

THE OPTICAL, OPHTHALMIC AND PHOTOGRAPHIC EQUIPMENT INDUSTRY

TABLE C.1. TOTAL SALES OF THE OPTICAL INDUSTRY

REQUIREMENTS OF INDUSTRY l FROM THE OPT. INDUST. AS A FRACTION OF GROSS OUTPUT OF INDUSTRY l (β_{lk})	NUMBER OF THE INDUSTRY (l)	SALES OF THE OPTICAL INDUSTRY TO INDUSTRY l AS A % OF GROSS OUTPUT OF THE OPTICAL INDUSTRY (α_{kl})	REQUIREMENTS OF INDUSTRY l FROM THE OPT. INDUST. AS A FRACTION OF GROSS OUTPUT OF INDUSTRY l (β_{lk})	NUMBER OF THE INDUSTRY (l)	SALES OF THE OPTICAL INDUSTRY TO INDUSTR. l AS A % OF THE GROSS OUTPUT OF THE OPTICAL INDUSTRY (α_{kl})
0.00005	5	(*)	0.00007	46	(*)
0.00006	6	(*)	0.00014	47	(*)
0.00002	7	—	0.00194	48	(*)
0.00006	9	(*)	0.00026	49	(*)
0.00006	10	(*)	0.00017	50	(*)
0.00070	13	(*)	0.00009	51	(*)
0.00002	16	—	0.00007	52	(*)
0.00001	23	—	0.00066	53	(*)
0.00029	24	—	0.00146	54	(*)
0.00397	26	(3.1)	0.00009	55	(*)
0.00045	27	(*)	0.00238	56	(*)
0.00236	28	(*)	0.00032	57	(*)
0.00005	29	(*)	0.00041	58	(*)
0.00004	30	(*)	0.00004	59	(0.1)
0.00002	31	(*)	0.00204	60	(1.6)
0.00030	32	(*)	0.00010	61	(*)
0.00008	33	(*)	0.00544	62	(0.2)
0.00096	34	—	0.05332	63	(5.3)
0.00013	35	(*)	0.00001	64	—
0.00010	36	(*)	0.00001	68	—
0.00008	37	(0.1)	0.00038	69	—
0.00005	38	(*)	0.00008	71	—
0.00006	39	(*)	0.00868	72	(6.5)
0.00014	40	(*)	0.00785	73	(11.9)
0.00050	41	(*)	0.00585	74	—
0.00015	42	(*)	0.00439	76	(1.5)
0.00006	43	(*)	0.00318	77	(4.5)
0.00007	44	(*)	0.00180	81	—
0.00007	45	(*)	0.00785	82	—

(*) Sales to other industries not mentioned.

TABLE C.2. TOTAL REQUIREMENTS OF THE OPTICAL INDUSTRY

REQUIREMENTS AS A PERCENTAGE OF THE GROSS OUTPUT OF INDUSTRY *I*	NUMBER OF THE INDUSTRY (*I*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE OPTIC. INDUSTRY	REQUIREMENTS AS A PERCENTAGE OF THE GROSS OUTPUT OF INDUSTRY *I*	NUMBER OF THE INDUSTRY (*I*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE OPTICAL INDUSTRY
0.1	7	(0.00152)	0.3	53	(0.01270)
*	12	(0.00032)	0.2	55	(0.00372)
*	16	(0.00051)	*	58	(0.00341)
*	17	(0.00030)	*	62	(0.01343)
*	18	(0.00082)	5.3	63	(0.05332)
*	20	(0.00007)	0.1	65	(0.01540)
0.5	24	(0.03145)	0.1	66	(0.00295)
0.3	25	(0.00649)	*	68	(0.00354)
*	26	(0.00025)	0.1	69	(0.04076)
0.8	27	(0.05869)	*	70	(0.00572)
*	28	(0.00067)	*	71	(0.01251)
*	29	(0.00007)	*	72	(0.00119)
*	30	(0.00019)	0.4	73	(0.05514)
*	31	(0.00255)	*	74	(0.00124)
0.2	32	(0.00707)	*	75	(0.00055)
*	33	(0.00007)	*	76	(0.00003)
*	34	(0.00047)	*	77	(0.00099)
0.7	35	(0.01066)	0.1	78	(0.00204)
0.1	36	(0.01817)	*	79	(0.00010)
*	37	(0.00570)	*	80A	(0.03855)
0.4	38	(0.02622)	0.6	80B	
0.3	41	(0.00584)	0.2	81	(0.00988)
0.2	42	(0.00971)	0.1	82	(0.00069)
0.2	47	(0.00420)			

Not included:

13	(0.00124)	47	(0.00124)	56	(0.00432)	61	(0.00049)
23	(*)	50	(0.00062)	57	(0.00013)	64	(0.00165)
45	(0.00025)	51	(0.00049)	60	(0.00006)		

Appendix D

THE GLASS AND GLASS PRODUCTS INDUSTRY

Table D.1. TOTAL SALES OF THE GLASS INDUSTRY

REQUIREMENTS OF INDUSTRY l FROM THE GLASS INDUSTRY AS A FRACTION OF THE GROSS OUTPUT OF INDUSTRY l (β_{lk})	NUMBER FO THE INDUSTRY (l)	SALES OF THE GLASS INDUSTRY TO INDUSTRY l AS A % OF THE GROSS OUTPUT OF THE GLASS INDUSTRY (α_{kl})	REQUIREMENTS OF INDUSTRY l FROM THE GLASS INDUSTRY AS A FRACTON OF THE GROSS OUTPUT OF INDUSTRY l (β_{lk})	NUMBER OF THE INDUSTRY (l)	SALES OF THE GLASS INDUSTRY TO INDUSTRY i AS A % OF THE GROSS OUTPUT OF THE GLASS INDUSTRY (α_{kl})
0.00013	1	(0.2)	0.00011	44	(*)
0.00004	8	(*)	0.00003	45	(*)
0.00163	11	(3.9)	0.00030	46	(*)
0.00483	12	(3.7)	0.00014	47	(*)
0.00091	13	(0.2)	0.00005	48	(*)
0.00929	14	(27.5)	0.00005	49	(*)
0.00215	16	(1.1)	0.00005	50	(*)
0.00074	17	(0.1)	0.00025	51	(*)
0.00001	19	—	0.00276	52	(0.2)
0.00117	20	(0.4)	0.00088	53	(0.2)
0.01409	22	(2.1)	0.00183	54	(0.2)
0.03723	23	(2.5)	0.02885	55	(3.0)
0.00004	24	(*)	0.00452	56	(1.2)
0.00188	25	—	0.03181	57	(3.8)
0.00148	27	(0.8)	0.00064	58	(*)
0.00027	28	(0.1)	0.01001	59	(10.6)
0.01995	29	(6.0)	0.00013	60	(0.1)
0.00013	31	(0.1)	0.00503	61	(0.9)
0.00639	32	(1.9)	0.00311	62	(0.5)
0.00004	33	—	0.01066	63	(0.7)
0.00008	34	(*)	0.00493	64	(1.2)
0.04826	35	(4.8)	0.00016	65	(0.2)
0.00078	36	(*)	0.00111	69	(4.6)
0.00006	37	(0.1)	0.00009	71	—
0.00003	38	(*)	0.00026	72	(0.1)
0.00002	39	(*)	0.00019	74	—
0.00372	40	(1.4)	0.01226	75	(4.4)
0.00101	41	(0.2)	0.00028	77	(0.3)
0.00025	42	(0.1)	0.00033	81	—
0.00053	43	(0.1)	0.00045	82	—

(*) Not mentioned: 18.

TABLE D.2. TOTAL REQUIREMENTS OF THE GLASS INDUSTRY

REQUIREMENTS AS A % OF THE GROSS OUTPUT OF INDUSTRY *l*	NUMBER OF THE INDUSTRY (*l*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE GLASS INDUSTRY	REQUIREMENTS AS A % OF THE GROSS OUTPUT OF INDUSTRY *l*	NUMBER OF THE INDUSTRY (*l*)	REQUIREMENTS AS A FRACTION OF THE GROSS OUTPUT OF THE GLASS INDUSTRY
*	6	(0.00004)	0.1	50	(0.00066)
0.1	7	(0.00130)	*	53	(0.00065)
1.5	9	(0.01122)	0.1	55	(0.00253)
0.1	10	(0.00029)	*	58	(0.00005)
*	12	(0.00044)	*	62	(0.00089)
*	17	(0.00005)	*	63	(0.00013)
*	18	(0.00119)	*	64	(0.00087)
0.4	20	(0.01511)	0.2	65	(0.02584)
2.6	21	(0.00533)	0.1	66	(0.00296)
*	24	(0.00223)	0.4	68	(0.03624)
4.6	25	(0.07561)	0.1	69	(0.03894)
*	26	(0.00149)	0.1	70	(0.00971)
0.7	27	(0.03789)	*	71	(0.00722)
*	29	(0.00149)	*	72	(0.00172)
*	30	(0.00004)	0.1	73	(0.01532)
*	31	(0.00308)	*	74	(0.00091)
0.1	32	(0.00380)	*	75	(0.00073)
*	34	(0.00001)	*	76	(0.00004)
4.8	35	(0.04826)	*	77	(0.00106)
0.8	36	(0.02830)	0.1	78	(0.00256)
*	38	(0.00217)	*	79	(0.00040)
0.2	41	(0.00455)	0.4	80B	(0.02117)
0.1	42	(0.00393)	0.3	81	
0.1	47	(0.00147)	0.1	82	(0.00920)
0.1	49	(0.00137)	1.7	83	(0.00077)

Not included:

19	(0.00001)	40	(0.00041)	54	(0.00038)
22	(0.00227)	44	(0.00021)	57	(*)
23	(*)	45	(0.00019)		

Appendix E

VALUE ADDED AS PERCENTAGE OF GROSS OUTPUT BY INDUSTRY

INDUSTRY NUMBER	VALUE ADDED IN PERCENT	INDUSTRY NUMBER	VALUE ADDED IN PERCENT	INDUSTRY NUMBER	VALUE ADDED IN PERCENT
1	34.3	29	41.7	56	44.3
2	50.7	30	36.4	57	49.7
3	39.0	31	20.1	58	42.1
4	44.7	32	45.5	59	29.0
5	35.3	33	31.2	60	47.0
6	36.0	34	43.9	61	38.0
7	58.3	35	55.5	62	45.5
8	61.5	36	48.3	63	52.0
9	57.3	37	39.5	64	40.1
10	52.3	38	28.2	65	60.4
11	35.5	39	33.6	66	85.2
12	61.2	40	38.4	67	57.3
13	34.7	41	43.9	68	48.9
14	25.6	42	42.8	69	72.4
15	48.0	43	42.3	70	56.0
16	25.5	44	35.8	71	72.2
17	24.5	45	44.1	72	60.8
18	38.6	46	36.6	73	45.9
19	23.0	47	50.6	74	47.7
20	32.2	48	44.0	75	48.1
21	36.3	49	43.3	76	53.2
22	41.6	50	53.1	77	68.1
23	44.7	51	56.3	78	43.6
24	34.8	52	34.1	79	54.4
25	37.4	53	49.2	80	—
26	47.2	54	37.3	81	—
27	38.6	55	46.6	82	—
28	39.5				

Source: 1958 Input-Output Table

Appendix F

CONSTRUCTION CONTRACTS-VALUE, BY GEOGRAPHIC DIVISIONS, 1958

In millions of dollars.

New England	1,801
Middle Atlantic	6,279
East North Central	6,636
West North Central	2,362
South Atlantic	5,279
East South Central	1,723
West South Central	3,461
Mountain	1,980
Pacific	5,425
United States	34,946

(Contribution of Construction to GNP 19,870 million dollars—Calculation of GNP per geographic division accordingly).

Appendix G

MANUFACTURING INDUSTRIES FOR WHICH VALUE ADDED WAS COMPUTED

NUMBER IN THE 1958 INPUT-OUTPUT TABLE	SIC CODE (APPROXIMATED)
14	20
25	265
24	26−265
26	27
27	281+286+287+289
29	283+284
35	321+322+323
38	33−331−332
51	357
53	361+362
56	365+366
57	367
59	371
63	383+385+386
62	38−383−385−386

Source: Census of Manufacturers 1958.

Appendix H

REGIONAL DISTRIBUTION OF VALUE ADDED OF RELEVANT INDUSTRIES EXCLUDING CONSTRUCTION

Millions of dollars

NUMBER IN THE 1958 INPUT-OUTPUT TABLE [1]	NEW ENGLAND	MIDDLE ATLANTIC	EAST-NORTH CENTRAL	WEST-NORTH CENTRAL	SOUTH ATLANTIC	EAST-SOUTH CENTRAL	WEST-SOUTH CENTRAL	MOUNTAIN	PACIFIC	UNITED-STATES TOTAL
14	743	3,568	4,308	2,212	1,717	875	1,220	482	2,404	17,529
25	128	427	421	116	163	29	60	7	151	1,502
24	512	797	972	192	632	290	314	34	468	4,212
26	518	2,788	2,025	601	585	218	326	147	714	7,923
27	102	1,038	967	290	866	510	1,180	122	430	5,505
29	178	1,740	1,274	293	168	61	42	4	197	3,957
35	13	391	513	28	190	60	67	—	90	1,153
38	378	768	1,102	103	171	183	275	326	661	3,967
51	125	316	94	—	1	—	—	—	248	784
53	241	879	941	123	149	42	30	13	257	2,675
56	232	948	1,000	9	127	—	24	—	186	2,526
57	233	557	285	46	40	47	52	8	167	1,435
59	53	799	4,611	435	319	110	96	8	318	6,749
63	120	690	109	14	10	—	3	1	27	974
62	250	745	487	150	35	22	65	9	157	1,920
GNP	28,900	99,600	96,900	35,600	53,400	20,000	34,700	15,600	59,600	444,300

1. For correspondence with the SIC Code, see Appendix G.

Appendix I

A DESCRIPTION OF THE ACTIVITIES OF THE CHOSEN INDUSTRIES[1]

I.1. A description of the activities of the electronic components industry (SIC 367).

367 Electronic components and accessories.

3671 *Radio and television type electron tubes, except cathode ray*

Establishment primarily engaged in manufacturing radio and television type electron tubes, except cathode ray tubes. Establishment primarily engaged in manufacturing television receiving type cathode ray tubes are classified in Industry 3672; transmitting tubes in Industry 3673; X-ray tubes in Industry 3693; and electronic equipment for home entertainment, except tubes, in Industry 3651. Industry 3671 was formerly part of old Industry 3662.

3672 *Cathode Ray picture tubes*

Establishments primarily engaged in manufacturing television receiving type cathode ray tubes. Establishments primarily engaged in manufacturing other radio and television receiving type electron tubes are classified in Industry 3671; and transmitting tubes in Industry 3673. Industry 3672 was formerly part of old Industry 3662.

3673 *Transmitting, industrial, and special purpose electron tubes*

Establishments primarily engaged in manufacturing transmitting, industrial, and special purpose electron tubes. Establishments primarily engaged in manufacturing radio and television transmitting equipment are classified in Industry 3662; radio and television receiving tubes in Industry 3671; television receiving type cathode ray tubes in Industry 3672; and X-ray tubes in Industry 3693. Industry 3673 was formerly part of old Industry 3662.

3679 *Electronic components and accessories, n.e.c.*

Establishments primarily engaged in manufacturing specialty resistors for electronic end products; solid state electronic devices and similar devices; inductors; electronic transformers, and capacitors; and other electronic components, n.e.c. Establishments primarily engaged in manufacturing resistors, inductors and transformers for telephone and telegraph apparatus are classified in Industry 3661; and electric lamps in Industry 3641. Industry 3679 was formerly part of old Industry 3661 and old Industry 3662. In addition, connectors for electronic applications formerly classified in this industry are now considered primary to Industry 3643, Current Carrying Wiring Devices.

I.2. A description of the Optical, Ophthalmic and Photographic Equipment Industry (SIC 383, 385 and 386).

383 Optical instruments and lenses.

3831 *Optical instruments and lenses*

Establishments primarily engaged in the production of optical lenses and prisms, and in manufacturing optical instruments such as microscopes, telescopes, field and opera glasses; and optical measuring and testing instruments such as refractometers, spectrometers, spectroscopes, colorimeters, polariscopes. Establishments primarily engaged in manufacturing eyeglass lenses, frames, or fittings are classified in Industry 3851; and those engaged in manufacturing sighting and fire control instruments, but not engaged in manufacturing optical components, in Industry 1941.

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[1] Source: 1958 Census of Manufactures. Appendix B. Industry Descriptions.

385 Ophthalmic goods.

3851 *Ophthalmic goods*

Establishments primarily engaged in manufacturing ophthalmic frames, lenses, and sunglass lenses. Establishments primarily engaged in manufacturing slit lamps are classified in Industry 3841, and molded glass blanks in Industry 3229. Industries primarily engaged in grinding lenses and fitting glasses to prescription are classified in trade industries.

386 Photographic equipment and supplies.

3861 *Photographic equipment and supplies*

Establishments primarily engaged in (1) photographic apparatus, equipment, parts, attachments, and accessories, such as still and motion picture cameras and projection apparatus; photocopy and microfilm equipment; blue-printing and diazotype (white printing) apparatus and equipment; and other photographic equipment; and (2) sensitized film, paper cloth and plates, and prepared photographic chemicals for use therewith. Establishments primarily engaged in manufacturing photographic paper stock (unsensitized); and paper mats, mounts, easels and folders for photographic use are classified in Major Group 26; photographic lenses in Industry 3831; photographic glass in Major Group 32; chemicals for technical purposes, not specifically prepared and packaged for use in photography, in Major Group 28; and photographic flesh, flood, enlarger and projection lamps in Industry 3641.

I.3. A description of the activities of the glass and glassproducts industry (SIC 321,322 and 323)

321 Flat glass.

Establishments primarily engaged in manufacturing flat glass and glass products not specifically classified in other industries. For example, establishments primarily engaged in manufacturing the following glass products are not included in this group of industries: complete electric light bulbs; electronic or X-ray tubes (classified in Major Group 36, Electrical Machinery and Equipment), ophthalmic goods including prescription sun glasses and eye-protective goggles (classified in Industry 3851, Ophthalmic Goods), glass fabrics classified in Industry 2221, Weaving Mills, Synthetic), glass insulation (classified in Industry 3296, Mineral Wool).

3221 *Flat glass*

Establishments primarily engaged in manufacturing flat glass, including plate glass, clear window glass, rolled glass, figure and wire glass, opalescent and obscurex glass, spectacle glass, and cathedral and skylight glass. This industry includes also establishments that produce laminated glass from glass produced in the same establishment.

Establishments primarily engaged in manufacturing laminated glass from purchased flat glass are classified in Industry 3231, Glass Products made of Purchased Glass.

322 Glass and glassware pressed or blown.

3221 *Glass Containers*

Establishments primarily engaged in manufacturing glass containers for commercial packing and bottling, and for home canning. Products of this industry may be machine-made or hand-made and include ampoules, carboys, cosmetic jars, fruit jars, medicine bottles, milk bottles, and vials.

3229 *Pressed and Blown Glass and Glassware, n.e.c.*

Establishments primarily engaged in manufacturing glass and glassware, n.e.c., pressed, blown, or shaped from glass produced in the same establishment. Establishments primarily engaged in manufacturing textile glass fibers are also included in this industry, but establishments primarily engaged in manufacturing glass wool insulation products are classified in Industry 3296, Mineral Wool.

Establishments primarily engaged in the production of pressed lenses for headlights, beacons, and lanterns are also included in this industry, but establishments primarily engaged in the production of optical lenses are classified in Industry 3831; Optical Instruments and Lenses. Establishments primarily engaged in manufacturing glass containers are classified in Industry 3221, Glass containers and complete electric light bulbs in Industry 3641, Electric lamps.

323 Glass products made of purchased glass.

3231 *Glass products made of purchased glass*

Establishments primarily engaged in manufacturing glass products from purchased glass, including laminated or safety glass, stained, leaded, ornamented, and decorated glass; mirrors; cutware; scientific apparatus glass; glass novelties; mosaic glass; round glass; cut, beveled, and etched glass; and glass watch crystals. Establishments primarily engaged in manufacturing optical lenses and ophthalmic lenses are classified in Major Group 38, Instruments and Related Products; glass fabrics in Industry 2221, Weaving Mills, Synthetic; glass insulation in Industry 3296, Mineral Wool; glass fishing rods in Industry 3949; Sporting and Athletic Goods, n.e.c.

Appendix J

TOTAL NUMBER OF EMPLOYEES IN GROUPS AND SUBGROUPS OF THE CHOSEN INDUSTRIES IN 1958[1]

CODE	NUMBER OF EMPLOYEES *Thousands*
367	197.9
3671	37.0
3672	8.6
3673	20.1
3679	132.2
383	7.2
3831	7.2
385	18.2
3851	18.2
386	60.3
3861	60.3
321	21.2
3211	21.2
322	92.0
3221	54.9
3229	37.1
323	24.0
3231	24.0

[1] *Source:* Census of Manufacturers 1958. Appendix B: Industry Descriptions.

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Appendix K

CONTENTS OF THE SITE SELECTION CHECK-LIST[1]

I. MARKETS

Suggested sources: Topographic maps (United States Geological Survey), maps and economic studies of local state and regional planning and administrative units, Census Bureau data, Survey of Buying Power (Sales Management magazine), aerial and ground photographs, state and local industrial directories.

A. *Location*

Detailed layout of urban area—streets, existing and proposed highways, railroads, topography, land use including existing and proposed industrial land, zoning patterns, political subdivisions.
Distance and means of access to major metropolitan areas.
Area in which city is dominant retail centre, dominant wholesale centre.

B. *Population trends*

Growth trend.
Age composition (especially age groups 15-19, 20-44, 45-64).
Sex, racial and national origin composition.
Urban, suburban, rural non-farm, rural Institutional population, if any.

C. *Income trends*

Total, per capita and per family income.
Disposable income.
Size of various income groups.

D. *Consumer characteristics*

Average family size.
Occupations.
Home ownership.
Automobile registration.
TV. major appliance ownership.

E. *Retail sales trends*

Division of sales by retail categories (department stores, drug stores, etc.).
Seasonal variations in trade.
Items in unusual local demand (such as water sports equipment, air conditioners, water softeners).

F. *Industrial markets*

Major economic activities, by SIC number.
Major industrial purchases and output (check input-output study of area if available).
Trend of industries moving into and out of area—reasons for moves.
Growth industries, including announced plants not yet built.
Branches of nationally known firms.

G. *Competition*

Past sales in area by company, as compared with competitors.
Location of competitors.

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[1] Published by courtesy of the Industrial Development and Manufacturers Record, Atlanta (Ga.).

Possible new location of competitors in region as reaction to your new location.
Possible new competition within area.
Future market share of likely competitors.

II. BASIC MATERIALS AND SERVICES

Suggested sources: Chambers of commerce, industrial directories, railroad freight agents, local employers.

A. *Each raw material*

Location of suppliers.
Quantity and quality produced.
Amount produced available to new customers.
Delivery time, interruptibility.
Long-term production outlook.
Alternate suppliers.

B. *Each semi-finished material*

As for raw materials.

C. *Storage facilities*

Public warehouses.
Bulk storage terminals.

D. *Routine supplies*

Mill supplies.
Building materials.
Maintenance supplies.
Office supplies and equipment.
Distance to warehouses and distributors of above, if not local.

E. *General services*

Subcontractors.
Machine shops.
Realtors.
Attorneys.
Architects.
CPA's.
Job Printers.
Advertising agencies.
Credit bureau.
Catering, food vending.
Janitorial.
Plant protection.
Telephone answering.
Employment offices.

F. *Technical services*

Laboratories—product research, testing, chemical analysis, instrumentation.
Computers.
Consultants—management, engineering.
Blueprint service.
Industrial photography and X-ray.
Instrument, machinery repair.

III. LABOUR

Suggested sources: local employment agencies, including representatives of state employment service and the United States Department of Labor's Bureau of Labor Statistics; census data; other employers; local and regional development agencies; newspaper want-ads.

A. *Labour force inventory*

1. Total labour force within feasible commuting radius.

2. Number and per cent unemployed during last five years.
3. Seasonal variations in employment.
4. Categories of employment: agricultural, manufacturing (by type), government, other non-agricultural (by type). Not available for employment (military institutional and student population).
5. Analysis of potential employables by skills (skilled, semi-skilled, unskilled, clerical, professional).
6. Skills notably abundant in area, or in short supply.
7. Analysis by age, sex, national and racial origin, educational level.
8. Management potential. Your requirements for next five years. Number of college graduates. Undergraduate and graduate programmes of colleges. Executive development programmes in colleges for non-students. Executive development programmes of various associations and organizations.

B. *Wages and hours*

Local wage rates, by occupation.
Fringe benefits usual in the area.
Average work week.
Overtime compensation.
Local holidays.
Domination of wage structure by single company or industry.
Cost of living index.

C. *Productivity*

Other employers' experience as compared with their plants in other areas.
Absenteeism.
Turnover in various industries.
Accident rates.
Local practices on lunch periods, coffee breaks, rest periods.

D. *Unions*

History of unions in area.
History of organization attempts.
Time lost due to strikes in last five years.
External or local control of unions.
Caliber of union leadership.
Union political activity.
Restrictive practices, secondary boycotts.
Attitude toward automation, other technological change.

E. *Personal policies in area*

Trial periods.
Seniority rules.
Promotion procedure.
Transfer procedure.

F. *Vocational training*

Facilities and programmes available.
Plans for new programmes, facilities.

G. *Labour legislation*

State "right-to-work" law.
Minimum wage law.
Laws regulating union activity.
Fair employment practices law.
Laws concerning collective bargaining.
Local employer experience with regional NLRB office.
Laws dealing with secondary boycotts or injunctions.
Safety and health laws.

H. *Recruiting*

Public and private employment agencies.

College and trade school employment services.
Newspaper, radio and television advertising.
Posters, open meetings, direct mail, other recruiting means.

I. *Commuting patterns*

Normal radius for plants in the area.
Variations in commuting range due to sex, age group and rural residence.
Radius for higher-paying plants.

J. *Relocation*

Public and union relations at time of announcement of relocation.
Cost of termination.
Selection of employees to move.
Information about new community for these employees.
Employee moving expenses.
Financial allowance for employees who move.

IV. TRANSPORTATION

Suggested sources: freight and passenger agents of railroads, airlines. Agents of trucking, bus and water transport lines; time tables, freight rate schedules.

A. *Location economics*

1. Cost estimates of assembly of raw and semi-finished raw materials at proposed site.
2. Cost estimates of reaching major markets.
3. Processing costs (labour, taxes).
4. Comparison of these costs with similar data for alternate sites.
   Those near major source of raw materials.
   Those near major market.
   Those in intermediate locations.

B. *Rail transportation*

Lines serving city.
Classification territory.
Daily freight and passenger service.
Shipping time to particular cities.
Group and commodity rates.
Carload rates—minimum size of carload.
Less than carload rates.
Piggy-back and other interchange services.
Demurrage.

C. *Rail service at site*

Relation of siding to main system.
Switching frequency.
Reciprocal switching.
If no siding, probable cost.
Apportionment of cost between plant and railroad.
Effect of siding on plant design.
Complications: sidings jointly used, public road crossings.

D. *Highway transportation*

Distance to nearest interchanges on Interstate Highway System—existing or proposed routes.
Access to other major highways.
Condition of roads and streets and length.
Weight restrictions and height and length limitations.
Bond issues for new roads.
Toll roads—amount of toll.

E. *Trucking service*

Companies serving area—local, intrastate, interstate.
Terminals and facilities.

Overnight service radius.
Schedules—trips per day.
Rate structure.
Specialized equipment.

F. *Other motor transportation*

Local rapid transit—facilities, schedules, proposed extensions. Wastes.
Nearest service to plant site.
Inter-city bus service—terminals, schedules.
Taxi service—rates, adequacy of service, radio equipment.
Car rental.

G. *Commercial air service*

1. Airlines serving area—passenger and freight schedules.
2. Jet service, if any.
3. Airport facilities—terminal—runway—length, surfacing, lighting, radio and radar, distance from city and plant site.

H. *Other air service*

Airfield usable by executive aircraft.
Hangar and office facilities.
Other facilities as for major airport.

I. *Water transportation*

Channel width and depth.
Depth alongside site, if on waterway.
Distance to channel, if not adjacent.
Lines serving area—schedules, rates, commodities handled.
Port facilities—warehousing, transit shed, storage area, stevedoring.
Port authority, if any.
Interchange facilities.
Seasonal limitations.
Icebreakers.
Insurance rates.

J. *Pipelines*

Size of tap allowable.
Commodities—natural gas, oil, refined products.

V. POWER AND FUEL

A. *Power source*

Thermal—coal, natural gas, fuel oil, lignite.
Hydro-electric.
Other—nuclear, geothermal.

B. *Electric power supply*

1. Company or public agency serving area.
2. Capacity—present and planned.
3. Recent record of shortages or interruptions.
4. Vulnerability to natural disasters.
5. Interconnections.
6. Voltage, phase and cycle available.
7. Size of connection at proposed site.
8. Two-way feed.
9. Rates based on your demand for: lighting, machine operation, air conditioning, welding, furnaces.
10. Typical residential rates.
11. Off-peak possibilities.
12. Fuel adjustment provisions.

C. *Gas service*

Capacity, present and planned, as compared with peak requirements.

Allocation for industrial use.
Type (natural, mixed, manufactured) and BTU value.
Storage facilities.
Recent record of interruptions.
Size of connection at proposed site.
Two-way feed.
Industrial and residential rates, including interruptible rate.

D. *Coal, oil*

Cost of coal delivered, per million BTU's.
Cost of oil delivered per million BTU's.

VI. TELECOMMUNICATIONS

Locale telephone company.
Number of instruments in use vs. capacity.
Capability for handling large installations.
Teletype service.
Private wire system.
Microwave radio.

VII. WATER AND WASTE DISPOSAL

A. *Regional water situation*

Trend of consumption as compared with developed supplies, planned developments.
Watershed development proposals for export of water to or import from other watersheds.

B. *Local water supply*

1. Agency and source of supply.
2. Pumping and storage capacity.
3. Average and maximum use as compared with present or proposed supply.
4. Pressure at site.
5. State health department rating of supply.
6. Method and extent of treatment, including fluoridation.
7. Industrial and residential rates.
8. Chemical analysis: hardness—alkalinity-acidity, solids, oxides, chlorides, nitrates, sulfates.

C. *Surface water—streams and lakes*

Daily, seasonal and long-term flow variations.
Upstream uses.
Temperature.
Chemical analysis as above.
Distance to site.
Feasibility of dam or pumping station.

D. *Ground water—wells*

Recent trend of water table elevation.
Recharge rate.
Regulations on use.
Pumping cost.
Temperature, chemical analysis.

E. *Sewage disposal*

Local sewage disposal agency, if any.
Present and proposed capacity, as compared with present and projected load.
Ordinances on industrial wastes.
Cost of service.
Space on proposed site for lagoon, if necessary to process wastes.

F. *Stream pollution*

Regulatory bodies and applicable lesgislation.
Cost of treatment necessary to meet regulations.

Other sources of pollution and existing control procedures.
Probable future requirements.

G. *Garbage and trash disposal*

Schedules and rates.
Location and type of incinerator.

H. *Air pollution*

Record of smog or smoke trouble.
Effect of local topography on air drainage.
Aerial waste of existing industries.
Regulations governing emission of smoke
Progress in reducing pollution.
Probable future requirements.

VIII. CLIMATE

Suggested sources: Nearest United States Weather Bureau office; weather handbook, Conway Research, Inc., 2600 Apple Valley Road, Atlanta, Georgia 30319.

A. *Monthly average maximum and minimum and long-time extreme temperatures*

B. *Degree: days by month*

C. *Number of days over 90° and number under 32°.*

D. *Period between killing frosts*

E. *Average monthly rainfall, snowfall*

F. *Maximum rainfall, snowfall in 24 hours*

G. *Monthly averages of relative humidity*

H. *Monthly wind velocity, prevailing wind direction*

I. *Number of clear, partly cloudy and cloudy days*

J. *Number of days with poor visibility and low ceilings*

K. *Special weather hazards—hurricanes, tornadoes, dust or hail storms, droughts, floods*

L. *Climatic effects:*

On building design, construction and maintenance
On cost of heating and air conditioning
On transportation to and from plant
On operations within plant, including technical processes
On employee morale and recruiting.

IX. COMMUNITY FACILITIES

A. *Housing*

1. Location of in-town, suburban residential areas.
2. Areas served by all utilities.
3. Slum areas.
4 Urban renewal—public and private progress, method of financing, effect on other areas of city.
5. Undeveloped acreage in city.
6. Photographs of typical areas and homes.
7. Housing available in various price ranges.
8. Housing built in last five years.
9. Typical construction—basements, garages, frame, brick, air conditioning, setback, sidewalks.
10. Lot sizes and costs.
11. Building costs per square foot for various types of house.
12. Rental units—size range, rentals, lease requirements, terms of leases.
13. Apartments—type, rentals, terms of lease.

B. *Travel and meeting facilities*

1. Hotels and motels. Number of rooms. Maximum and minimum rates. Recognition by national hotel and motel associations. Convention and meeting facilities. Major conventions accomodated—attendance and schedules.
2. Auditorium, arena, exhibition hall. Capacities, special facilities.
3. Restaurants. Number and capacity. Inspection by local health authorities. Banquet and meeting facilities. Noted specialities.

C. *Shopping facilities*

Major department stores, including parking provisions.
Speciality stores.
Branches of metropolitan stores.
Shopping centres.

D. *Communication media*

1. Newspapers—local and major out-of-town. Number and time of editions. Circulation. Editorial philosophy.
2. Television. Channels, affiliations. Quality of reception. Local interest programmes of special quality. Educational TV.
3. Radio. Call letters and reception. Quality of programmes.
4. Other media. Trade publications. Farm journals.

E. *Mail and express service*

Number, location and hours of local post offices.
Frequency of delivery—business areas, residential.
Parcel post zone.
Express service—area served, average shipment time to major cities.
Messenger service.

F. *Organization*

1. Civic, fraternal and social groups.
2. Business organizations.
3. Outstanding programmes.
4. Extent of active participation.
5. United Fund. Results of last three drives. Per capita giving. Agencies included and those conducting separate drives. Participation by local industry-employee contributions by payroll withholding.
6. Professional societies. Number, membership. Frequency of meetings. Programmes conducted.

G. *Political and social attitudes*

1. Proportion of population registered to vote and voting in national and local elections.
2. Business leader participation. Election to local office. Service on planning boards, school boards, tax councils. Local businessmen prominent at state and national levels.
3. Economic education programmes.
4. Ethnic, racial and religious groups prominent in local affairs.
5. Reception accorded new residents.
6. Restriction on sale of alcoholic beverages.
7. Unusual "blue laws".

H. *Amenities and intangibles*

Points of unusual historic or scenic interest.
General physical aspects of the community.
Prestige factors.

X. EDUCATION

A. *Number, enrolment, teachers for:*

Public schools—elementary, junior high, senior high.
Parochial schools—elementary and high.
Private schools.
Teacher-pupil ratio.

B. *Cost of Education per pupil*

C. *Investment per pupil and public school*
Debt per capita

D. *Teacher requirements and salary scales*

E. *Building expansion programme*
"Split-shifts" needed.

F. *Condition and appearance of buildings and grounds*

G. *Special facilities—libraries, laboratory facilities*

H. *Special programmes for exceptional students*

I. *Trade and business courses in regular high schools*

J. *Adult Evening classes—vocational and avocational*

K. *Kindergartens and nursery schools*

L. *School buses—areas served*

M. *Status of desegregation*

N. *Colleges and universities in 50-mile radius*

Enrolment, faculty.
Degrees granted, graduate programmes.
Evening courses offered.
Extension programmes.
Special facilities for research.
Research programmes undertaken for industry in the last five years.
Expansion programmes.

O. *Vocational schools*

Courses offered.
Curricula flexibility.

XI. CULTURAL ASPECTS

A. *Libraries* (including university)

Number of volumes.
Branches, bookmobiles.
Circulation, budget.

B. *Legitimate theater*

Travelling shows last five years.
Local repertory groups.

C. *Musical groups*

Symphony orchestra.
Choral and chamber music groups.

D. *Lecture and concert series*

E. *Museums and art galleries*

F. *Discussion groups—forums*

XII. RECREATIONAL FACILITIES

A. *Parks—acres per 1,000 population*

B. *Playgrounds*

C. *Golf courses*

Ownership.
Fees and membership dues.

D. *Tennis courts*

E. *Water sports facilities*

F. *Winter sports facilities*

G. *Bowling alleys—number of lanes*

H. *Professional sports*

Stadium capacity.
Baseball, football, basketball, hockey, boxing.

I. *Race tracks—racing days per year*

J. *Team sports facilities*

Little league baseball and football.
Softball leagues.

K. *Theaters, including drive-ins*

L. *Hunting areas nearby—types of game*

M. *Summer camps*

XIII. CHURCHES

Denominations represented, number of churches.
Percentage of church membership.
Leading faiths in the area.
Interfaith groups.
Community activities.
Attitudes of church leaders toward business and industry.

XIV. MEDICAL AND HOSPITAL FACILITIES

A. *Hospital and clinics*

Bed capacity of each.
Semi-private room rate.
Special equipment.
Rating.

B. *Medical personnel*

General practitioners.
Surgeons.
Specialists.
Number per 1,000 population.

C. *Dentists*

D. *Ambulance service*

E. *Public Health programmes*

F. *Industrial health regulations*

G. *Welfare and relief administration*

Groups assisted.
Number of social workers.
Source of funds.

XV. POLICE AND FIRE PROTECTION

A. *Law enforcement*

Personnel per 1,000 population.
Annual expenditure for police force.
Equipment.
Surveillance of industrial areas.
Cooperation with county and state police.
Crime and juvenile delinquency rates, major categories.
Performance during strikes and labour disputes.
Traffic regulation during shift changes at plants.
Municipal courts.
Injunctions against illegal strikes or picketing.
Personnel attrition.
Training programmes.

B. *Civil defense*

Shelters in downtown area.
Trained disaster squads and civil defense units.

C. *Fire protection*

Personnel per 1,000 population—volunteer or paid.
Fire insurance classification.
Extent of protected area.
Stations—location and time to outer limits of protected area.
Equipment, including that for chemical fires.
Water pressure for fire fighting.
Fire inspection of local industry.
Sprinkler system requirements.
Personnel attrition.
Training programmes.

XVI. PLANNING AND ZONING

A. *Planning commission*

History and make-up.
Status of "master" or "comprehensive" plan.
Use of professionals in preparing master plan and in administering plan.
Co-ordination of plan with those of adjoining areas.
History of overall economic planning.
Attitude of planning commission toward industrial growth in the community.
Relationship with governing body.

B. *Industrial zoning*

1. Definition of industrial and research areas.
2. Protection against residential or commercial encroachment.
3. Provisions on: smoke, dust and dirt. Odour. Noise. Noxious gases. Glare and heat. Fire hazards. Industrial wastes. Aesthetic requirements. Off-street parking and loading.
4. Policies on zoning changes and variances.

C. *Building codes*

Date written, recent revisions.
Unusual requirements.

D. *Traffic and parking*

Professional supervision of traffic planning.
Routing of through traffic.
Adequacy and plans for downtown and industrial area parking.

E. *Streets*

General condition of surfaces.
Percentage unpaved, particularly in industrial areas.

Street cleaning facilities.
Snow removal facilities.

XVII. LOCAL GOVERNMENT AND TAXES

A. *Structure of municipal government*

Elected and appointed officials—responsibilities, terms of office.
Background of incumbents.
Local political structure—relation to state and national parties.
Record of local government—honesty, efficiency, major policies.

B. *Financial condition*

Annual budget.
Sources of revenue.
Debt per capita.
Salaries of local officials.

C. *Civic attitudes*

1. Attitudes of city officials toward industry.
2. Attitudes of city officials toward bordering jurisdictions—county or other municipalities. Attitude of public toward city government.
3. Problem areas. New revenue sources. Public improvements. Redevelopment of private property. Annexations.

D. *Local taxes*

1. Property taxes—real and personal. Tax rates for last five years. Method of tax assessment and equalization. Balance between tax loads on industrial, commercial and residential property. Amount of tax-free property in area. Local tax revenue per capita.
2. School taxes, if separate.
3. Local sales or use tax; if any.
4. Local license taxes, if any.
5. Comparison of local tax load with services rendered.

XVIII. STATE GOVERNMENT AND TAXES

A. *As above for structure, financial condition and attitudes*

B. *State regulations and legislation. See also "Labour-Legislation"*

Private use of natural resources.
Laws affecting incorporation of businesses.
Laws affecting out-of-state corporations.

C. *State taxes*

1. Personal income tax. Rate, exceptions and deductions. Method of collection.
2. Corporate income tax.
3. Sales, use of payroll taxes.
4. Unemployment compensation tax—rates; administration.
5. Workmen's compensation tax.
6. Inventory, machinery, equipment taxes.
7. Franchise, incorporation taxes.
8. Gasoline, liquor and tobacco taxes.
9. Vehicle and other license fees.

D. *Total state and local tax load, as compared with services rendered*

E. *Future tax prospects in the area, in view of needs for major capital improvements*

XIX. FEDERAL ACTIVITIES IN AREA

Nearby government installations.
Federal aid to schools in impacted areas.
Incentives offered in depressed areas.
Special consideration offered in contract awards in depressed areas.

XX. REPRESENTATION IN CONGRESS

Voting record of representatives and senators on issues of key interest to business.
Committee positions held by area representatives.

XXI. FINANCING

A. *Requirements*

New building or existing structure.
Lease or buy.
Purchase lease-back.
Effect of alternate proposals on working capital.
Effect on tax liability.
Payout time.

B. *Source of funds*

Company funds.
Sale of stock.
Short-term bank loan.
Private long-term loan or mortgage.
Pooling of institutional funds.
Merger.
Loan from affiliated firm.
Loan from supplier.
Insurance company.
Mutual funds.
Local development corporation.
Regional development corporation.
State development corporation (privately financed).
State development authority (publicly financed).
Small business administration.
Area redevelopment administration (in depressed areas).

C. *Credit factors*

Reputation of firm.
Type of business.
Length of time in business.
Quality and continuity of management.
Training of young executives.
Earning history.
Cash position.
Other short-term and long-term commitments.
Size and type of plant—adaptability for other uses.

D. *Factors effecting loan terms*

General business conditions.
Length of loan.
Interest rate.
Importance of industry to community.

E. *Special inducements*

Free land.
Free plant.
Nominal rent.
Low interest rate.
Tax incentives.

XXII. INDIVIDUAL SITES

A. *Requirements*

Initial building area.
Foreseable expansion needs.

Parking, storage and utility areas.
Total site requirements.

B. *Type of site*

Planned industrial district.
Urban, suburban, rural.
Waterfront or airport frontage.
Redevelopment area.
Drained or reclaimed land.
Graded land.

C. *Geologic considerations*

Depth to solid rock and character of intervening soil strata.
Bearing loads as compared with requirements.
Variation in ground water level.
Flood risk.
Drainage pattern after plant construction.
Earthquake risk.
View of building from distance and from within building.
Neighbours.

D. *Legal check-points*

Title.
Easements.
Protective covenants.
Abandoned cemeteries.

E. *Cost of Land*

Initial cost, assuming secrecy of plants is maintained.
Cost of improvements.
Broker fees.
Probable appreciation of land values.

F. *Vacant buildings*

Photographs and floor plans.
Type of construction.
Floor loadings.
Ceiling heights.
Suitability for special equipment.
Loading docks.
Sale price and terms, or leasing costs.
Existing tax assessment.

XXIII. OVERSEAS FACTORS

Suggested sources: United States for international development, Washington, D.C. and missions in specific countries: International Bureau of United States Department of Commerce.

Washington D.C.; banks with international departments; United States Embassy in specific country; national government of specific country.

A. *Political situation in the country*

International orientation.
Stability of regime.
Attitude of leading political parties toward foreign capital.
Protection against expropriation of foreign companies.

B. *Economic situation*

Level of living—per capita income.
Trends in gross national product as compared with population growth.
Fiscal stability.
Record of repayment of foreign debts.
Trends in United States and other foreign investment.

C. *Regulations affecting foreign concerns*

Requirements for setting up local corporations.
Percentage of capital that may be foreign.
Percentage of all employees and of supervisory employees that may be foreign.
Feasibility of joint operations or mergers with existing local firm.
Transfer of earnings out of the country.
Convertibility of currency.
Taxation of foreign-owned companies.
Special inducements offered to foreign investment.
Labour and welfare legislation.
Restrictions on exploitation of natural resources.

D. *Tariffs and customs regulations*

Tariff rates on raw materials and components.
Export taxes on finished products.
Participation in regional tariff agreements such as the Common Market.

E. *Other factors*

Electric power system—cycles, voltage, phase.
Railroad gauge.
Freight car capacity.
Units of measurement.
Time differences from New York, London.
Language.
Local taboos and unusual product preferences.

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